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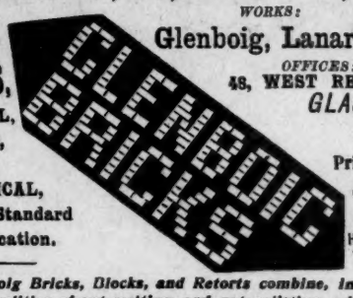

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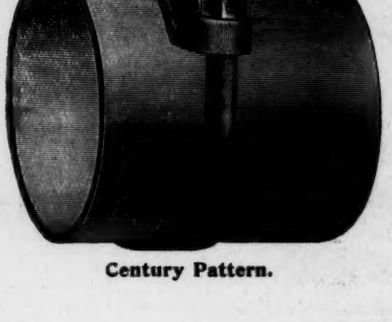

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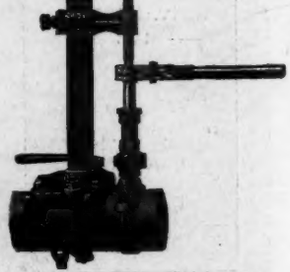

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EDITORIAL NOTES.

Foreign Competition in Gas and Electrical Goods.

THE Board of Trade have appointed, among others, a Committee to consider the position of British trade in electrical plant and appliances after the war, with special reference to international competition, and to report what safeguarding steps, if any, are necessary or desirable. The Committee, numbering six members, includes not only representatives of manufacturers and sellers of plant and apparatus, but home buyers. The reason the latter have been included is probably due to the recognition by the Board of Trade that electrical imports in the past have been of an order that does not assist the fiscal conditions of the country, while benefiting those of other countries—more especially enemy ones; and these imports mean that the home purveyors and consumers of electricity are buyers of the foreign-made goods. We could do with a similar Committee in the gas industry, although gas undertakings have not been such large sinners as electrical concerns in the matter of the purchase of exotic goods.

Gas plant is not, as a rule, purchased from abroad; but large electric generating sets and machines have had a considerable importation. A company once entered into a contract with German builders for a gasholder. The war intervened; and the holder has not been constructed. Another gas undertaking entered into a contract for carbonizing chambers; and difficulty was experienced through the war in bringing their construction to a happy issue. Gas-mains have been purchased from abroad; but our own pipe makers never allowed the foreign produced pipes to get the upper hand. Fire-clay goods in relatively small quantities have journeyed here from abroad; but this has always been due to personal views as to some greater virtue in regard to quality than is found in the British productions. The few cases of gas plant contracts going abroad have been (practically wholly) owing to price; and our makers of refractory goods have now the question of a higher standard of qualitative production well in hand. Were a Committee appointed by the Board of Trade to make strict inquiry into the trade of this country with gas undertakings abroad, and the trade of countries abroad with gas undertakings in this country, the members would have no difficulty whatever in unanimously reporting that, in respect of large gas plants, and other gas manufacturing and distributing goods, our exports have far and away exceeded our imports, and that there ought not to be much difficulty in wiping-out any differences between home sellers and buyers of such plant and goods, so that in future imports would, as a general rule, appear as "*nil*." The Committee could make practically the same report as to gas-engines, gas-fires, cookers, furnaces, and other domestic and industrial appliances for heating purposes. But, in the gas-lighting department, the report would have to confess there has been a serious lapse, in the industrial interests of the country, on the part of both manufacturers and buyers. In mantles, fittings, and glassware, gas undertakings and gas consumers have helped to insert a heavy golden lining in the pockets of manufacturers abroad. However, enough about our own industry. A Committee has not yet been appointed in regard to its trade and international competition, and perhaps never will be. If one be appointed, its work will not be particularly serious, as it will be a fairly easy matter to get to the details of the whole story of incoming and outgoing foreign business.

However, the Committee appointed for the electrical trades has in its composition the Hon. Charles A. Parsons, K.C.B., F.R.S., the distinguished inventor, and head of a manufacturing firm. Mr. J. Annan Bryce, M.P., is also a Director of a manufacturing company. Mr. T. O. Callender's name is prominently identified with a cable firm. Mr. James Devonshire is a contractor. Mr. B. M. Drake is engaged in the administration of electric and traction supply; and Sir John Snell, Past-President of the Institution of Electrical Engineers, is a Consulting Electrical Engineer. An article on the scope of the work of this Committee has appeared in "The Times Engineering Supplement." The announcement as to the appointment of the Committee, as one of a series of similar investigating bodies, particularly states that its duties are to inquire into and consider the position of the electrical trades after the war, with special reference to international competition. There is no international competition in the supply of electricity; but it is interesting and amusing to find in the article in question that the writer seems to think the Committee's functions will include the review of general electric legislation and the want of amendment of that legislation. He is of opinion that the constitution of the Committee will be justified if it will report on the relationship between the general public service legislation and the arrested growth of British electrical manufacture. Then, there is that rather extensive and much-debated question as to "what should be done to "accelerate the long-delayed reorganization of electric supply "for Greater London?" The writer of the article opines that it will be within the province of the Committee "to "study such questions, and to report how encouragement "should be given to electrical development at home, as one "means of incidentally sustaining the manufacturing de-"partment and giving it greater competitive power in the "foreign markets." The Committee, too, it is thought, might well concern itself with the removal of vexatious restrictions which retard such development. The perennial controversy concerning the hiring and selling of consumers' apparatus by municipal supply undertakings should also now be brought to a close. These matters of legislative policy and control are all essentially ones for Parliament, and Parliament would no doubt prefer to make its own investigations before legislating upon them. Certainly if these large questions were intended to come within the purview of the Committee, its constitution would have been somewhat different. Furthermore, the writer in "The "Times" should bear in mind that the idea is that the work of the Committee shall bear fruit "after the war," and not after the extinction of the present generation.

"Real" Premier Organizations.

IN view of the articles on "Central Organization" that have appeared in the last three issues of the "JOURNAL," there has been more than ordinary interest in reading a contribution to the "Chemical Trade Journal" from the pen of Mr. C. T. Kingzett, F.I.C., under the heading of "A "Plea for a Real Institute of Chemistry." Better organization—nationally, industrially, and otherwise—is in the air; at every turn its claims vibrate in our ears, and our eyes are assailed by them. It is a subject that is engaging the minds of the thoughtful; for—no matter whether custom or preconceived opinion blinds a few individuals, and causes them to prefer perpetuation to needful change—the major part of the intellect of the country cannot survey the present conditions, nor picture possible new-world conditions that will eventuate from the great international upheaval, without recognizing the necessity generally for a higher standard of, and more complete, co-operative organization with a view to national and industrial advancement. Such improvement in organization must be common to every quarter of the country's work; otherwise we shall be having the spectacle of the best organized industries making good progress, while others—perhaps subject to competition—with less efficient organization will be left behind in the great progressive move.

Some of the old-established organizations which, with their methods, gave satisfaction within the limits of their

particular spheres are ill-qualified, from one or more causes, for the more extensive work and interests of to-day; and, therefore, they will be less so for the work and interests of to-morrow. Hence the necessity for reformation—reformation drastic and complete, and not mere patchwork. The condition of ill-qualification does not exist in one direction only; it is admitted that it is pretty general. One manifestation of this is the calling together by the Royal Society of representatives of various learned and technical bodies (ignoring in so doing the Institution of Gas Engineers, the Council of which are endeavouring to secure representation), with the view of forming a Joint Board of Scientific Societies for the purpose of organizing scientific effort in the country. This in itself reflects the recognition that organization as it exists in this country is not sufficient for the needs of the time, and the peculiar and more insistent ones that will follow the war. But we are not at all convinced that such a Joint Committee is the best way of doing anything really effective in dealing with scientific effort, present or future, in relation to industry. More profitable work, in our opinion, is to be accomplished by thorough organization, persistent activity, and bold enterprise by and in each industry. This is evidently the view, too, of Mr. Kingzett, seeing that, in his article, he "takes stock" of the existing chemical organizations, and considers what can be done to improve their status and usefulness. To put the matter briefly, he finds the societies of the chemical industry disjointed and overlapping in objects and functions. There are the Institute of Chemistry, the Chemical Society, the Society of Chemical Industry, the Society of Public Analysts, and other allied Societies. The absence of concrete organization and unity in prosecuting aims, in the author's opinion, involves much waste of time, energy, and money, deals imperfectly with many of the relations of chemistry to industry, the arts and manufactures, and agriculture, while at the same time the interests of the profession are insufficiently safeguarded. "None of "the several societies," the indictment runs, "in their "present independent capacities takes an active part in "keeping in touch with each other or with Government "departments; and, consequently, there is little or no "official recognition of the importance of their objects, and "the nation loses all the advantages which would accrue "to the State if the subject-matters with which they deal "were properly co-ordinated as between themselves and "with official Government departments." In so writing, Mr. Kingzett might, *mutatis mutandis*, have been dealing with the gas industry, although the gas industry does not suffer so much from the number of organizations as from the inadequate representation of interests and power in the premier body.

But as we have said of the gas industry, so of the chemical industry. There is nothing to be gained by any attempt at patchwork reformation of organization. The work has to be done thoroughly or not at all. In the case of the chemical industry, various suggestions have been made. One is for a new Society of Chemical Engineers. Another for an Association of Firms Engaged in Chemical Manufacture and its Allied Industries; this proposal having emerged from a conference between the Councils of the Chemical Society, the Society of Chemical Industry, and the Society of Dyers and Colourists. Additional organizations of this character do not in reality meet the requirements; and Mr. Kingzett is solely for consolidation of what exists—for "that co-operation and effectiveness which is so "much to be desired, and which would necessarily follow "if the different societies were merged into one comprehen-"sive college or institute," with the various departments treated sectionally. Then with such real representative organization of the whole of the chemical industry, there would have to be a far more commodious and fitting home than the present Burlington House quarters of the Chemical Society and the new premises of the Institute of Chemistry. "There should be a handsome new building, provided with "plenty of good large rooms for the meetings of the various "councils or committees dealing with sectional matters; "larger accommodation rooms for grand committees and the "general council, one or two ample lecture rooms, general "libraries dealing with the various branches of chemical "science and its applications, and so forth." Mr. Kingzett hopes a really great effort in these directions will be made by the chemical industry, so that there may be brought into existence "an Institute of Chemistry worthy of the "country and the Empire."

What Mr. Kingzett desires in the way of a representative and powerful organization for the chemical industry is what far-seeing people wish for the gas industry. Through such an organization, a larger measure of brains and influence, with greater diversified experience, would be brought to bear upon the work of the industry; it would, internally and externally of the industry, receive larger recognition than any of the present organizations; and it would put the industry into its proper position in the eyes of the parliamentary and other authorities, as well as in those of the public. Somehow or other, and we cannot obscure the fact, the gas industry (though it does not deserve it) seems to be looked upon from the outside as something of second-rate importance. This must not continue. The catholic representation of the British Commercial Gas Association has given it larger power than ever the Institution can hope to possess under its old constitution, which constitution properly fits it for confining its activities mostly to technical discussion. If those who have defended the old constitution as being suitable for a central organization would only study the question of representation in relation to influence (as illustrated, within its limits, by the British Commercial Gas Association), there would be no difficulty in arriving at a definite conclusion as to what manner of organization would best serve the interests of the gas industry. And the interests of the gas industry are what we all have, or all should have, at heart.

Spontaneous Combustion of Coal.

THERE are occasions when one is inclined to marvel at the great waste of time caused by the Committee system of inquiry, as well as the squandering of public money in having evidence reported and printed, a large part of which is the common knowledge of people who have made a study of the matter. This is a reflection perhaps not only upon the system of inquiry, but on the composition of the Committees. The report of the evidence submitted to the Home Office Committee who sat away back in 1913 to investigate the question of the spontaneous ignition of coal in mines—and what applies to mines applies with perhaps greater force to stacked broken coal above ground—has, as seen in last week's and the present issue of the "JOURNAL," been published, and affords a case in point. We have searched in vain through the evidence bearing upon the question of the spontaneous ignition of coal to see whether any one challenged or combated the causes of the action that have been accepted and ratified now over a long period. There was failure. Witness after witness merely confirmed what had previously been known and published. Had the Committee appointed one competent person to prepare for them a *précis* of current knowledge as to the chemical actions and physical conditions contributing to spontaneous combustion, they would have saved their own time, that of the witnesses, much expense, and the Committee themselves would have been able to appreciate better the substance of this knowledge than—if they were not well informed before—they could possibly do from the diffuse evidence placed before them. What does the evidence amount to? That ignorance of the experiments of Percy first and Richters later—though now nearly half-a-century old—kept alive the notion that the oxidation of pyrites in the coal alone accounted for its heating-up and ultimate spontaneous combustion; that the percentage of pyrites has alone little to do with the liability of a coal to spontaneous ignition; that coal containing as low as 0·75 per cent. of pyrites has been known to be subject to the action; that the pyrites only contributes to the general rise in temperature; that the general organic composition of the coal determines its absorbing power for oxygen; that as oxidation begins, the temperature of the coal rises, and as the temperature increases, so does the chemical activity and the avidity of the coal for absorbing oxygen, until the culminating point of ignition is reached; and that the smaller the coal the greater the surface exposed to the process of oxidation. All this and more was pointed out in the late Professor Lewes's Cantor Lectures at the end of 1911; and he then confirmed the causes assigned by earlier workers as the ones contributing to the spontaneous ignition of coal. Subsequent work by other investigators has produced additional corroboration. Much of the evidence given before the Departmental Committee could have been gained by them in more concise form by consulting prior publication—such as the lectures by Professor Lewes.

Annual Meeting of the Institution.

The annual meeting of the Institution is to be more or less a business affair, and much like the one of last year, only perhaps there will be other matters of importance about which to talk. Although the proceedings are to be confined to one day—and members in these times of difficulties as to coal, oil, and labour supplies, and "bolts" from above and landwards from the sea cannot afford a long absence—there is no doubt as to a good attendance to support the President, Mr. John Young. His presence in the chair will alone suffice. There will be interest in listening to his Presidential Address, which will probably follow the precedent of war times, and be limited in extent. Among the business matters down for consideration will be the annual report of the Council and the reports of the different Committees. In all likelihood the report of the Council will suggest matters upon which members will wish to express their individual views; but whether the reports of the Committees will give any scope for discussion is not known. There will also be the annual general meeting of the subscribers to the Benevolent Fund. Cordial welcome will be accorded to Mr. A. E. Broadberry as successor to the Presidential Chair; Mr. Samuel Glover continues in the office of Senior Vice-President; and Mr. Thomas Berridge will take office as Junior Vice-President. Mr. W. E. Price remains—and no one is better qualified—in the office of Hon. Secretary.

Assailing the Four-Shilling Standard.

There has been talk for a long time past as to the colliery owners making an effort to, under sub-section 2 of clause 1 of the Price of Coal (Limitation) Act, secure the sanction of the Board of Trade to the raising of the standard of 4s. per ton of coal allowed in excess of the "corresponding price" for 1913-14. The Forest of Dean owners have obtained the permission of the Board to the raising of the standard to 5s.; but in this case the position of the collieries supplies exceptional circumstances. Now it is seen that, in view of the last advance in wages to the English miners, the Midland and South Yorkshire owners have applied for authorization to charge (we understand this refers to house coal) 6d. more than the standard. The Welsh owners are also accused of seeking an increase of 1s. It is reported, too, that towards the end of last week there was a meeting in London to consider matters relating to the gas coal section of the industry; and one can make a shrewd guess as to the matters then discussed. There does not appear to be any particular reason for the increase of the standard price, seeing that it was clearly proved, at the time the Act was passed, that the 4s. contained a respectable margin. If the Board grant the increase, they may be assured that there will shortly follow another application from the miners for a further advance of wages, which, if successful, would be succeeded by the owners making another claim for an increase of the standard addition. So the merry game would go on. The last advance to the miners was made upon the prices already obtained by the colliery owners, and not upon the doubtful prospect of the realization of an addition to the standard price. Evidently their position justified the advance to the men, or it would not have been allowed. However, it is stated that this application to the Board of Trade is a cause of the delay on the part of the owners in settling new contracts. This is another reason supplementing those advanced in the article that appeared in the "JOURNAL" for April 4 (p. 10) as to the difficulties surrounding coal-contract making this season. These reasons had birth in the artifices of coal owners. Corroborative evidence was supplied by Sir Arthur Markham shortly afterwards in the House of Commons. [See our "Parliamentary Intelligence," April 11, p. 91.]

The Meter-Index Test.

The old question as to whether or not meter indexes should be tested has been revived at Manchester; and the Corporation Gas Committee and the City Justices are, in a friendly way, tenaciously defending their respective positions in the matter. The former are desirous, on the ground of economy and uselessness of the test, of having it discontinued; and the Meter-Testing Committee of the City Justices, with an unsubstantial case, are equally anxious that the test shall be continued. The whole dispute resolves itself into a question as to whether the money and time expended upon the test are compensated by sufficient results. The Gas Committee say "No;" the Meter-Testing Committee, "Yes." Alderman Kay, the Chairman of the Corporation Gas Committee, and Mr. F. A. Price, the Superintendent of the Gas Department (as seen by the correspondence that has passed between them and Colonel H. T. Crook, the Chairman of the Justices' Meter-Testing Committee), think that a personal conference may remove the deadlock by showing the futility of the test, and the wasting of further money upon it. The test has been applied for about fourteen years; and, according to the annual report of the Meter Inspector (Mr. S. Dyson), during that long period only some 900 meters have been rejected for index error, which means the low average of 64 per annum. Yet last year alone there were 39,263 meters tested. It appears that the cost of making the additional test is about £400 per annum. If this sum has been expended for the purpose per annum over the whole fourteen years, the cost of index-testing alone has been something like £5600, which would represent an average outlay of about £6 4s. 6d. per defective index. So that probably more than the total cost of the meters has been expended (through the test) on each defective index. The Justices consider the abolition of the test a retrogressive action; the Gas Committee a matter, under the circumstances, of wise economy. The Justices should remember that the meter makers have greatly improved their processes during the past fourteen years, and never was more attention than now paid to the construction and reliability of the index mechanism.

Daylight Saving.

The saving of daylight appears likely to become a sort of universal summer fashion. Now it is stated that no less than ten European countries (that is to say, if the final decision of France is in favour) have decided to put their clocks forward one hour this summer—Germany, Austria, Turkey, Switzerland, Italy, Spain, Holland, Norway, Sweden, and (probably) France. Mr. H. W. M. Willett (the son of the late Mr. William Willett, who was the originator of the scheme), also states that various cities in Canada and the United States have adopted the system during summer time. This is all very interesting. It shows that the difficulties foreshadowed when the matter has been under discussion in this country are not feared by other countries. However, those who are responsible for central electricity supply stations are not contemplating with pleasure the prospect of our own Government being persuaded that this saving of daylight is really a good line in economic policy. In residential areas, the saving of an hour's consumption of electricity is not a thing to be welcomed by suppliers; and in other districts where there is a fairly good day load at thin prices, the revenue from lighting is something that central station engineers dearly require to maintain. Unwilling as the gas industry is to forego, if it can be avoided, any of its lighting consumption, it has a respectable day load, and its prices for different services are not so widely divided as in the case of electricity supply.

Prisoners of War in German Gas-Works.

Reference was made in the "JOURNAL" some time ago to a statement in the report of the proceedings at the annual meeting of the German Association of Gas and Water Engineers regarding the employment of prisoners of war in German gas-works; and a subsequent correction of what originally appeared in the official account was to the effect that the pay of these prisoners, after deductions had been made, amounted to 7½d. a day. Some further information on the subject has now been made available through the receipt by the Foreign Office of a report from Surgeon Karl Ohnesorg, of the United States Navy, in which he gives an account of visits paid to prisoners' working camps in or near the City of Berlin as recently as during the early days of last month. It was found that invariably the working hours were the same as for German employees, and no work as a rule was required on Sundays. But with two exceptions the conditions revealed, particularly with regard to housing, could not be regarded as satisfactory. It would seem that one of the exceptions is a gas-works, where, out of 300 prisoners of war employed, 46 are British. They are housed in sufficiently large wooden barracks, provided with good sanitary arrangements, including shower-baths, with hot and cold water. There is now no room for complaint as to the food; and the men are able to buy additional supplies at current prices. Of the British prisoners, 25 work in the retort-house, at a wage of 1 m. 50 pf. (about 1s. 6d.) a day; while the remaining 21 are employed on manual labour in the yard, the payment for which is 75 pf. daily. It is stated in the

report that the prisoners work on friendly terms with the German employees—which is doubtless the only thing they can do, under the circumstances. At the electric light works (where, again, they are housed in a specially constructed barracks, and the food supplied by the Company is good and sufficient), a daily wage of 1 m. is paid to the 27 British prisoners employed—chiefly in the unloading of coal and wheeling it into the power-house.

Water Heating by Gas.

The burst of summer weather last week led to the sudden discontinuance of house fires, kitchen ranges were promptly put out of action, the gas-cooker came into full use once more, and households without the convenience of some form of heating water by gas were deprived of the convenience—in many cases, the wasteful convenience—of the kitchen circulating boiler. Coincident with this change from winter conditions to summer ones, there is the discontent of householders generally over the high price of coal. They have felt its burden keenly during the past winter; and, scanning the "lowest summer prices," they find that the chances of cheaper solid fuel are somewhat remote. Under these circumstances, Mr. Thomas Newton, of Hereford, in an article in another column, urges that now is an especially opportune time to carry conviction home to householders that water heating by gas is the most economical and accommodating relief from their difficulties in this respect that they can have. Heating water by gas is a branch of business that requires more persistent attention than has yet been given to it. Gas-cookers are ubiquitous; gas-fires are receiving larger adoption on their own merits; but as to the various systems of heating water in large quantities by gas, the public are not sufficiently cognizant. The fact should also be dealt with that the public are so accustomed to the (through low thermal efficiency) uneconomy and time-squandering system of water-heating by means of the kitchen range boiler that they do not know the system for what it really is. There is much work to be done in this connection; but it is work that must be prosecuted on thoroughly good lines. Especially should the man in charge of this department be expert at dealing with the applications of gas to water heating under all sorts of conditions. Mr. Newton says "the expert should be master of his subject." Unless he is "master of his subject," he has no claim to the title of "expert." But there are men who profess and call themselves experts, and who are nothing of the kind. In the application of gas to water heating, they are to be rigidly avoided if complete satisfaction is to be given.

The Coal Question in France.

The minutes of the meeting of the Committee of the Société Technique du Gaz, published in the "Journal des Usines à Gaz" for April 30, record an inquiry which reflects the anxiety felt by many gas makers in France as to obtaining supplies of coal. M. Bigeard begged the Committee to take up the question of replacing coal by other materials capable of yielding gaseous products which could be employed for lighting. In the course of search for information on this question, M. Bigeard had discovered a volume by a former President of the Société, M. Alfred Mallet, published fifty years ago, and dealing with the distillation of substitutes for coal. He inquired whether, if necessity arose, recourse could be had to certain woods (such as resinous firs), and he asked for the experience of any of his colleagues who had employed such resinous woods. In response to this request, M. Deleury stated that at Petrograd he had had occasion to distil resinous woods, and that the results had been satisfactory. The wood charcoal left in the retort was saleable, though it was not comparable in this respect with gas coke. Another member, M. Kaeuffer, informed the Committee that he had made actual use of coal and olive husks. He had succeeded in using the husks in as high a proportion as 75 per cent., and had been satisfied with the results of distillation. The Committee decided that the matter should be referred to the Commission of the Société concerned with questions of manufacture, and that it should investigate the subject without loss of time.

Daylight Saving Bill for Holland.—A provisional Daylight Saving Bill has been presented by the Dutch Government to the House of Commons. Under the provisions of this measure, from May 1 to Oct. 1 of this year the legal time of the Amsterdam meridian would be put forward by one full hour. The change was to take place at midnight between April 30 and May 1, so that when midnight strikes it will be regarded as if 1 a.m. had struck. On the other hand, when midnight strikes on Sept. 30, it will be taken as to have struck 11 p.m. A noticeable fact is that, whereas the gas industry is practically indifferent towards the Bill, there is opposition from the electrical camp.

PERSONAL.

Mr. M. Drohan, of Carrick-on-Suir, has been appointed Manager of the Dungarvan (co. Waterford) Gas-Works. He has been Gas Manager at other places in Ireland—in Rathfirland, Bagnalstown, and Tipperary.

At length we are in a position to congratulate Mr. J. G. Tooms on the confirmation of his appointment as Administrative Director of the Christiania (Norway) Gas-Works, in succession to the late Mr. O. Pihl. It may be remembered that in the "Journal" for March 7 it was announced that the Board of Directors, at their meeting on Feb. 25, appointed (subject to confirmation by the Commune) Mr. Tooms as Engineer and General Manager of their present works, in addition to his former position of Chief Engineer for the construction of the new gas-works in the city. On March 15, however, the Commune passed a resolution to the effect that the position be advertised as vacant, and the question of Mr. Tooms's appointment be postponed till the result of the advertisement was known. The latest news—received in London last Friday—is that Mr. Tooms has been unanimously appointed to fill the vacancy.

To the names of the gas company officials mentioned last week as having been chosen to preside over the deliberations of their respective Councils, may be added others. Mr. Charles Turnbull, the Secretary of the Alnwick Gas Company, has been elected Chairman of the Urban District Council of the town. Mr. W. B. Reidie, the Manager of the Stratford Works of the Gas Light and Coke Company, has been re-elected Chairman of the Barking Urban District Council. This is the fifth time Mr. Reidie has filled the position. In returning thanks for the honour done him, Mr. Reidie expressed the hope that before the end of his new term of office the war would be over, and said he thought that, but for the fact of the war, he should not have accepted the position for a fifth time. Mr. W. T. Layton, the Editor of the "Co-Partnership Journal of the South Metropolitan Gas Company" ever since its start years ago, has been unanimously elected Chairman of the Camberwell Board of Guardians for the ensuing year.

On Saturday afternoon, the officials of the Birmingham Gas Department gave a hearty send-off to Sergeant W. C. Treen, D.C.M., of the 3rd South Midland Brigade R.F.A. (T.F.), who was returning to the front after a short leave of absence. Sergeant Treen is the first of the 800 employees of the City Gas Department now serving with the Colours to win the D.C.M., and throughout the department there is justifiable pride in this achievement of one of their most popular men. The D.C.M. ribbons were formally presented by Major Walduck, at the barracks; but the Gas Department supplemented the official award and the congratulations on the presentation by entertaining Sergeant Treen, and marking their sense of the honour conferred on the department by his conspicuous work on the battlefield by the gift of a gold watch, which the Office Superintendent (Mr. Tooley) handed to him. The D.C.M. was awarded to Sergeant Treen for long-continued work in the open, in dangerous areas, in maintaining the lines of communications between the battery and positions; the wires being often broken by enemy shells.

The Institution of Water Engineers.

The "Transactions" for 1915 of the Institution of Water Engineers, edited by Mr. Percy Griffith, M.Inst.C.E., F.G.S. (the Secretary), has been published by the St. Bride's Press, Limited. A copy has been sent to us; and from this it is seen that the present is the twentieth volume—the Institution having been established in 1896. The proceedings recorded are those at the June and December meetings (both, this time, held in London), when papers were read and discussed as already recorded in the pages of the "Journal." The President for the year was Mr. F. W. M'Cullough, M.Inst.C.E. (the Engineer to the Belfast Water Trust), who was asked, and agreed, to continue to hold the position for another twelve months. The three papers and discussions, with the general business, and an obituary section, occupy close upon a hundred pages. All the contributions were valuable; but the one of most general interest was that on the "Definition of the Term 'Domestic Purposes' in General and Private Water Acts," submitted by Messrs. A. B. E. Blackburn and Percy Griffith at the December meeting. For members wishing to consult earlier "Transactions," reference is facilitated by the inclusion in the book of a summary of the contents and a subject-matter index to Vols. I. to XX.

Measuring High-Pressure Natural Gas.—As the result of experiments, the United States Bureau of Mines report that they have found that in measuring natural gases at high pressures there are in many instances mistakes as great as 10 per cent. or more where Boyle's law is used. Boyle's law is now found to be true only for pressures close to atmospheric. The Bureau state that pressures of 300 lbs. per square inch or greater are common. At 100 lbs. the error is 3 per cent.; at 200 lbs., 6 per cent.; at 375 lbs., 11 per cent.; and at 520 lbs. an error of 15 per cent. has been found. Natural gas at these pressures is more compressible than an ideal gas—for which Boyle's law holds good.

OBITUARY.

The death is announced, as having taken place on the 24th ult., of Mr. EDWARD CATCHPOLE, senior partner in the firm of Catchpole and Sons, tar distillers, of Rotherhithe. Mr. Catchpole died in a London nursing home at the age of 61.

The death occurred somewhat suddenly last Saturday week of Mr. ROBERT H. GAYNER, a Sunderland shipowner. Deceased, who was 85 years of age, some years ago occupied the position of Chairman of the Sunderland and South Shields Water Company.

Much sympathy will be felt with Mr. David Hunter Anderson, of Bastia, Corsica, at the loss he has sustained in the death of his two sons, Second-Lieutenant GEORGE JOHN ANDERSON and Second-Lieutenant DAVID HORACE ANDERSON, who were killed at one of the theatres of war about a fortnight since.

Mr. WILLIAM SCOTT, the Secretary of the Hartlepool Gas and Water Company, died with tragic suddenness at West Hartlepool last week. He was proceeding from his residence in Clifton Avenue, to catch a tramcar, when he had a seizure, and died within a few minutes. Mr. Scott was a native of Peebles; and his early years were spent in the teaching profession at Edinburgh and Newcastle. In 1873, he entered the service of the Hartlepool Gas and Water Company, and succeeded Mr. Thomas Trewhitt as Secretary in 1900. Deceased, who was close upon 63 years of age, was a member of the North of England Gas Managers' Association, and also of the Commercial Section; but his somewhat retiring disposition, and the state of his health, accounted for his not taking an active part in the meetings. He was also a member of the Secretaries' Institute. His integrity, as also his first-rate business capacity, combined to win for him the esteem not only of the officials and employees of the Company, but also of a wide circle of friends in the two towns. This respect was amply testified to by the number of persons who followed the body to the railway station, on its way for interment at Peebles. Mr. Scott is survived by a widow, four sons, and two daughters.

THE INSTITUTION OF GAS ENGINEERS.

Notes from the Council Meeting.

A MEETING of the Council was held on Thursday last at the Queen's Hotel, Birmingham. In the unavoidable absence of the President (Mr. John Young, of Hull), the chair was taken by Mr. A. E BROADBERRY (Tottenham), the Senior Vice-President.

LOSSES OF MEMBERS.

The decease of the following members was announced; and an expression of the Council's regret at their loss was recorded:

M. Joseph Ancel, of Lyons (Honorary Member), Mr. Edward Allen, of Liverpool, Mr. George Collins, of Dudley, Mr. William Ford, of Stockton-on-Tees, and Lieutenant C. V. Townsend, who was killed in action.

THE MEMBERSHIP ROLL.

Applications were approved for the class of member from:

Mr. Edward Allison, of Gosport, Mr. William Clark Jackson, of Neath, Mr. William Henry Mainwaring, of Lincoln, Mr. Cecil John Robinson, of Spalding, and Mr. Harold Singleton, of Huddersfield.

Approved for the class of Associate Member were:

Mr. Douglas C. Cross, of Lea Bridge, Mr. Harold E. Stone, of Birkenhead, and Mr. S. E. Whitehead, of Southport.

The following were transferred from the class of Associate Member to that of Member:

Mr. J. G. Clark, of London, Mr. William H. Hammond, of Eastbourne, and Mr. Edward Frost Keable, of Gorleston.

PERSONAL.

It was resolved that the congratulations of the Institution be conveyed to Mr. H. E. Jones on his election as Vice-President of the Institution of Civil Engineers, and to Mr. Charles Carpenter, D.Sc., as Member of Council of the Institution.

It was reported that, on the recommendation of the Council, Mr. Walter Hole, of Leeds, had been re-appointed by the City and Guilds of London Institute to act for a further period as Examiner in "Gas Supply."

ROYAL SOCIETY AND THE INSTITUTION.

Correspondence was reported with the Royal Society in reference to the representation of the Institution upon the Conjoint Board of Scientific Societies. It was resolved that further action be taken, with a view to securing representation on this Board, and that a communication be addressed to the Royal Society indicating the important assistance which the Institution would be prepared to render.

OFFICE BEARERS.

Nomination of officers for the year 1916-17 took place:

As President, Mr. A. E. Broadberry; as Vice-President, Mr. Thomas Berridge (Mr. Samuel Glover remains in office as Senior Vice-President); as Hon. Secretary, Mr. W. E. Price.

The following were reported as having been appointed District Members of Council for the year 1916-17:

Mr. Walter Whatmough, of Heywood — Manchester District Institution of Gas Engineers.
Mr. Chas. H. Webb, of Stourbridge — Midland Association of Gas Engineers and Managers.
Mr. Wm. Hardie, of North Shields — North of England Association of Gas Managers.
Mr. W. Doig Gibb, of London — Southern District Association of Gas Engineers.

ANNUAL MEETING.

Arrangements for the annual meeting, to be held at the Institution of Civil Engineers, Great George Street, S.W., on Tuesday morning and afternoon, the 6th of June, were discussed. The business of the meeting will include the President's Address, the Annual Report of the Council, Benevolent Fund Annual General Meeting, Report of the Refractory Materials Research Committee, Report of the Ventilation Research Committee, Report of the Life of Gas-Meters Research Committee.

ORGANIZATION OF THE INDUSTRY.

The subject of organization in the gas industry was introduced; and it was decided to call a special meeting of the Council at an early date to consider the matter.

FUEL ECONOMY.

Mr. Douglas Helps, of Reading, was nominated representative of the Institution on the British Association Fuel Economy Committee in succession to Mr. Broadberry, who had resigned owing to pressure of other business which had arisen since his appointment.

FINANCIAL REGULATIONS FOR MUNICIPAL DEPARTMENTS.

An invitation was duly considered to assist in taking action with respect to the Regulations for Financial Organization and Administration drafted by the Institute of Municipal Treasurers and Accountants, the effect of which, if adopted, would be to place the financial control of every department, whether trading or non-trading, in the hands of the finance committee and the financial comptroller, who would over-ride the powers now exercised by the committees and chief officers of the various departments. It was agreed to accept the invitation; and a Committee composed of the following was appointed to deal with the matter: Messrs. S. Glover, John Bond, F. P. Tarratt, Hubert Pooley, W. Whatmough, W. W. Woodward, and T. E. Franklin.

ENLISTMENT OF OUTDOOR EMPLOYEES.

A report was received, *re* action taken since the last Council meeting with reference to the enlistment of outdoor gas-works employees. A deputation representing the Institution, the British Commercial Gas Association, and the Society of British Gas Industries had waited upon the Board of Trade Committee on Reserved Occupations, and a similar deputation had been received by Lord Moulton at the Department of High Explosives, and had obtained his Lordship's support in appealing for the exemption of essential men in the distribution and administrative sides of the industry. It was reported that communications between these departments were still passing on the subject.

TONNAGE, FREIGHTS, AND COAL SUPPLIES.

Correspondence was reported with the Board of Trade with reference to the shortage of tonnage, and to the unreasonable freightage charges on sea-borne coal. A letter from the Board had been received, stating that the general question is receiving their attention, and that various steps have been, and are being, taken with a view to meeting the difficulties which the Institution have laid before them.

With regard to coal supplies, prices, and transport, it was reported that a deputation representing the gas and electrical interests had attended at the Board of Trade, and laid before Mr. Marwood serious questions which had arisen in connection with the interpretation of the Price of Coal (Limitation) Act, also with regard to means for ensuring adequate supplies of coal and facilities for transport. The facts presented by the deputation were to be laid before Mr. Runciman; and it was hoped that measures of relief would be obtained. The situation had now become so acute that it was resolved to request the Coal Supplies Committee to take further and immediate action in the matter.

SULPHURIC ACID AND SULPHATE OF AMMONIA.

Representations made to the Board of Agriculture and Fisheries were reported as to the shortage of sulphuric acid, and in regard to the accumulation of stocks of sulphate of ammonia. The last communication from the Board contained the information that, with a view to relieving the congestion in the storage accommodation of the various producers, licences for the export of a certain quantity of sulphate of ammonia to France had been recently issued, and that it was proposed to recommence the consideration of applications for the export of further quantities.

GAS PLANT REPAIRS AND WAR WORK.

In regard to the Government control of output, it was reported that an application had been made to the Ministry of Munitions, asking that a general certificate should be issued classifying

orders for the manufacture or repair of gas plant and appliances either as "on an equality with war work" or as "necessary for the efficient conduct of the war." A reply had been received to the effect that details of orders relative to gas-works should be sent to the Gas Section of the Department of Explosives Supplies, where instructions would be issued enabling such orders to be graded. It was ascertained that gas-works plant could be classed in the "A" and "B" sections.

EXAMINATIONS.

The report was presented of the Committee on the Revision of Syllabuses of the Examinations in Gas Supply and Gas Fitting which had been recommended for the approval of the Department of Technology of the City and Guilds of London Institute.

Institution certificates for gas-fitters were issued to eleven candidates.

NEGLECT OF SCIENCE.

THE natural sciences have been too long disregarded in the educational courses of the great schools of the country; and the Committee on the Neglect of Science, of which Sir Ray Lankester, K.C.B., F.R.S., is Chairman, think this should be altered. Therefore, under the presidency of Lord Rayleigh, a meeting is to be held to-morrow afternoon, at three o'clock, at Burlington House to consider the subject. Resolutions will be proposed, expressing the view that it is a matter of urgency, in order to promote national efficiency, that the natural sciences should be made an integral part of the educational course in all the great schools of the country, and should form part of the entrance examination of the Universities of Oxford and Cambridge as well as of the newer Universities; that it is in the highest degree desirable that the Government should exercise the large power which it possesses of encouraging the study of the natural sciences, and thereby increasing the efficiency of our public servants. Several well-known public men are, it is announced, expected to take part in the proceedings.

At the annual meeting to-night of the Glasgow Section of the Society of Chemical Industry, Mr. Robert Hamilton, the Chairman, will speak on "The Recovery of Bye-Products from Blast-Furnaces."

It is reported, says the "Manchester Guardian," that two large firms who are at present engaged in Government work intend on the termination of the war to begin the manufacture of aniline dyes on a large scale. It is the intention of the companies also to manufacture alizarine.

Dr. Walter F. Rittman, the Chemical Engineer of the United States Bureau of Mines, has resigned from the public service; and it is stated that he will enter private employment in connection with the utilization of the process for the production of benzol and toluol, of which he is the inventor.

For the heating-up of tools of chrome-tungsten steel for the purpose of tempering them, gas is being employed in France. The temperature required is 1000° C. (equal to 1832° Fahr.); and the tool is plunged in a bath of fused caustic soda. Any defects in the tempering tend to shorten the life of the tool; and with gas tempering the life of a tool is said to be longer than that of a similar tool tempered with a coke or oil fire.

News has reached London that the steam coal boat "Wandle," the property of the Wandsworth, Wimbledon, and Epsom District Gas Company, while on her way with a cargo of coal, fell in with a German submarine. The "Wandle" fought-off the submarine, which is believed to have been sunk. The "Wandle" herself sustained some damage, including a hole in her stern, as a result of the encounter. It is reported that the pirate vessel carried a big sail as a disguise.

The President of the Board of Trade has appointed a Committee to control the supply and distribution of petrol, and to consider what measures are necessary in the national interest: (1) To ensure that adequate supplies of petrol shall be available for the purposes of the war and for other essential needs, (2) with this object to regulate the use of petrol for other purposes in the United Kingdom during the period of the war. The Committee are not prepared to consider individual applications for supplies of petrol.

In the editorial in the "JOURNAL" for April 18, dealing with the Board of Trade returns, allusion was made [p. 118, second column, second paragraph] to the fact that some 60 million cubic feet of gas was entered up to the Newport (Mon.) Gas Company as "oil gas," and it was suggested that its proper place was under "water gas." Mr. Thomas Canning (the Engineer) has since written explaining that the Company started making carburetted water gas in 1900, and there was then at Newport great prejudice against it, and very fabulous accounts of the method of manufacture were published. He therefore took the opportunity of letting them know that oil was used, and thought he was justified in applying the term "oil gas." But to-day the prejudice has, he remarks, died-down.

INDUSTRIAL USES OF GAS.

OUR French contemporary, the "Journal des Usines à Gaz," in bringing to a conclusion a series of chapters on the employment of gas in industrial processes of manufacture—for the most part of metal goods required for military purposes—instances the tempering of the steel charging-bands of machine guns, and prefaces a description of the gas-furnace used for this purpose by some remarks on the much wider adoption of gaseous fuel which it foresees as an economic necessity when industry sets out again on the conclusion of the war.

French industrialists, as our contemporary recognizes, will then be faced with several difficulties—viz., higher prices of raw materials, increased cost of skilled labour, and general heavier charges due to the greater cost of fuel, while the means of offsetting the total effect of these additional charges are few. Thus in anticipation of the commercial struggle with the Germans, French manufacturers will seek to introduce every possible means of reducing factory costs, in which endeavour, as the "Journal" very properly points out, the economy of material, fuel, and skilled labour resulting from the use of gaseous fuel for many manufacturing processes requiring heat, will be fully realized. Already in many and various applications coal gas at ordinary pressures has proved itself competent to render automatic industrial operations which without it would entail the constant attention of skilled workmen, and at the same time to avoid waste of material, while itself actually costing less than other sources of heat.

To give still another instance of these claims, reference is made to the steel-tempering gas-furnace worked out by the firm of "Air et Feu," of Argenteuil, for the manufacture of the small but vitally important charging-bands for machine guns. Each band weighs only 3½ oz. and measures 15½ inches in length and 2½ inches in breadth; each having 75 teeth, which form as many springs. The furnace designed for tempering these bands can treat 200 of them per hour. The temper requires to be very carefully done; for if a single spring on a band be over-tempered it is liable to break in fitting into the gun, rendering the whole band useless. Hence it is sufficient to mention the regular output, 20,000 bands per day from a battery of the furnaces, to indicate the certainty and efficiency of the gas-furnace for this delicate operation.

In the furnace used in the "Air et Feu" establishment, the gas is burned at the ordinary pressure in a series of atmospheric burners. The air supply for the latter is drawn through an inlet which is placed in the chimney conveying away the products of combustion, and by internal circulation is delivered at a temperature of 250° C. to the chamber, whence it passes to the burners. The flames of the latter completely envelop a muffle, accommodating six bands; the operator being protected from the great heat which is radiated by a screen through which cold air circulates. The burners having been adjusted for the temperature required, it is not necessary to touch them; if the gas pressure should vary slightly at certain times, the supply to the burners is increased or reduced by a tap fitted with an index-pointer, which simply requires to be moved upon a graduated scale.

ELECTRICITY SUPPLY MEMORANDA.

THE British Commercial Gas Association and its work bulk largely in the eyes and minds of some of our electrical friends. We had only just passed for press the reference in last week's "Memoranda" to what "Electrical Industries" had to say anent the energetic gas publicity body, when a number of the "Electrician" came to hand with, in the "Commercial Section," another tilt at the electricity industry for its supineness in this connection in the interests of its own business. In the times of peace, the electricity industry could not get together an effective publicity organization; and certain it is that it could not in this war time succeed in floating and organizing one on a proper scale. But, personally, we have never been able to see that the electricity industry really required a publicity organization, if veracity were a component of the valuation some of the electrical enthusiasts put upon the merits of their goods. The valuation was of such an order that, if true, no other recommendation or action would have been needed to make their goods go in popularity as never goods had gone before. In the case of gas, all that has been done is to advertise the capabilities of appliances; and the matter has been left at that without indulging in extravagance, or attempting to impose on credulity. But the envy with which the work by the B.C.G.A. is regarded—just now especially—is proof positive that the valuation electrically placed upon the merits of electric goods is not sufficient to gain their acceptance by the public; and thus the envious ones renounce all claim to any superlative merit or sufficiency of merit for that walk-over they once thought was about to occur.

Insufficiency of Electrical Valuation.

Motives and Exhortation.

The "Electrician" gathers that even the almost negligable operations of the newly-formed Development Committee of the Incorporated Municipal Electrical Association have ceased. While this is so, our contemporary, looking

at the advertisements of the B.C.G.A. through glasses tinted yellow by electrical prejudice, finds that the wording of many of them is such as "to give the impression that certain domestic operations are only economically possible with gas, and certain definite effects and results can only be produced by this agency." Moreover, "the phrasing is cleverly designed to create a mental atmosphere among the public, [do not omit the comma, Mr. Printer] which we think must be highly detrimental to electricity supply interests." This means that, if such an excellent work as creating a "mental atmosphere" among the public is accomplished by the B.C.G.A., the greater the determent to electricity supply interests. This is an admission—extending intelligence will result in harm to the electricity industry. The gas industry distinctly adopts the right course. It believes that increasing the knowledge of the public regarding the actual work of which gas is capable will benefit gas. It calls to its aid none of the embroidery such as appears to be necessary in the case of electricity. Our contemporary is fully convinced that "if this kind of thing goes on long enough, it will produce the effect which those who are responsible for it are desirous of obtaining." Our contemporary's penetration is marvellously keen. The "effect which those who are responsible for the work are desirous of obtaining" is the exact object of the work. Our contemporary must be congratulated on its insight into motives. It also says "it is not sufficient to presume that the electric service is in no need of advertising at a time when the charges for electrical energy are being consistently increased throughout the country, and side by side with the increase there is a very energetic propaganda for increasing the uses of gas." The "Electrician" overlooks the fact that the price of gas has also been increased. It evades the fact, too, that many electricity undertakings have, in the times of peace conditions, been living from hand to mouth, and not a few in those times have had to fall back on the ratepayers for support, and so have no funds in reserve with which to provide for business extensions. The unsound financial condition in many quarters in the electrical industry has been brought about by the craze for getting the last fraction of a penny off the price of electrical energy, in order to improve the immediate position in the competition, even though supremacy (as electrically proclaimed) was with electrical goods and not gas goods. However, our contemporary exhorts central station engineers not to allow gas men to deprive them of "the fruits of the labours in which they displayed considerable vigour before the war broke out." But we must dispute the statement of the "Electrician" "that the present campaign in the interests of gas is the largest hitherto attempted." The "present" campaign is not something separate from anything else that has preceded it. It is merely of a piece with—a continuation of—the same work; and it is not at the present time of greater magnitude than it was formerly. Still our contemporary thinks that the "present campaign," which is "the largest hitherto attempted," should bring the electricity supply industry sharply to its senses.

To Cheapen Electricity Supply.

In the editorial columns last week, there appeared an article dealing with the establishing of control boards for statutory industries; the matter having been reintroduced to consideration by a paper on the "Electricity Supply of Great Britain." Of this paper Mr. Ernest T. Williams was the author, and the Institution of Electrical Engineers were the recipients. It seems, on a closer reading of the paper, that the author intends his Board to be something more than a controlling body responsible to Parliament. He wants it to own large centralized electricity generating stations, and large bulk supply networks from which existing distributors may draw "juice." His idea apparently is that capital shall not be any further frittered away, if this is what has been done by putting up relatively small stations and extending them as required. He pictures lower capital costs per unit of output, and lower working costs. Against this would be the increased expense of altering the distribution mains and putting down transforming plant, with the loss of efficiency due to transformation. Leakage or unaccounted-for current would not be an insignificant item. Mr. Williams does not think that the technical considerations and the financial issues would be serious matters; but the basis of organization would be the important thing. With Mr. C. H. Merz (who opened the discussion on the paper), we agree that the technical considerations are of some moment. At present, there is nothing more pronounced than the disagreement between engineers as to whether large centralized stations would be an improvement on the existing stations. Mr. Williams was at some pains to show that he did not mean to scrap the best of the large existing stations; but he kindly suggests they should be the nucleus of large central stations. Even Mr. Merz, author of the great North-East Coast power scheme, warned that, if large areas were allowed to continue to depend upon one central station, there would be some serious collapse. As to the financial issues, these are far from being clear-cut. It will be very many years before capital is again obtainable on such cheap terms as in the past; and, with increased financial burdens upon all classes of enterprise, the prices of materials are bound to be maintained at high rates. And in electricity supply capital stands for a great deal. Then there are the advantages to the consumer. From the treatment for remedying the ills to which the electricity industry has been heir, there is to come cheapness of supply, with apparently the final collapse of the gas industry, which as one threat after another comes along laughs and continues to grow fatter still. But when electricity reaches that wondrously cheap rate, the importance of a town's electrical undertaking will be comparatively much greater than at present, seeing that, according to the prophetic Williams, "practically all indoor and outdoor lighting will be effected by electricity; also most mechanical power conveyances, cooking, and heating will be electrical." Let us just remind Mr. Williams of the low thermal efficiency of the electricity generating process before his visions take serious hold of him, and deprive him of the power of viewing things in reasonable perspective.

The Other Reason.

The reason why breakdowns are so rare in connection with gas supply, and so frequent in association with electricity supply, is generally attributed by electrical people to the difference between the one and the other service in the matter of storage. This is not altogether so; there is another and quite as powerful reason. It is that an accident may happen at one part of a gas-works, and only have local effect, without upsetting the whole of the manufacturing system; and the same in regard to the distribution service. The contrary is the condition in connection with an electric generating plant. The smallest mishap is sometimes the incipient cause of complete disorganization and collapse of the supply. The breakdown of the supply on March 3 at Winchester was due to the breaking of one of the piston rings in the intermediate cylinder of a large generating set. That was all; and it was sufficient to deprive users of current for half an hour just at the part of the evening when the demand was heaviest. When the matter came before the Council, there was much praise as to the skilful manner in which the Electrical Engineer and his staff successfully overcame the difficulty; but the report in an electrical paper does not record that there was any expression of sympathy with the consumers over the fortitude with which they bore their inconvenience.

When the Boot is on the Other Leg.

When the consumer of electricity for lighting is inquisitive, and asks why it is that his current costs so much more per unit than the current consumed by a householder (say) for cooking a chop, he is told, among other things, that the lighting comes on to the peak of the load, and that it is more expensive to generate current at the peak than at any other part of the daily output curve. Of course, the peak of the day's load in some areas is found during the day time in connection with the tramway and power services; but the lighting consumer does not find that this shifting of the peak from his period of use makes any difference to him. He still discharges his account at the "peak" price per unit. At King's Lynn, we imagine the peak of the load would be during the lighting hours. But we see that, according to the "Electrical Times," the Electrical Engineer states that "it is found that the discontinuance of the street lighting makes very little difference to the total cost of production." This is rather strange, as it may be taken for granted that, in ordinary times, the public lighting assists in forcing-up the peak. However, let us assume that the Electrical Engineer is right, then if the street lighting makes very little difference in the cost of production, why charge more for it than that "little difference"? It was not the object of the Electrical Engineer to show this; his purpose was to try to convince people that street lighting made such little difference to the cost of production that the department is entitled to be paid a substantial sum for the service, even though, we take it, no current is used. The estimate for street lighting for the current financial year is £1193; and the Mayor stated, at a recent Council meeting, that the amount allocated last year to the Electricity Department for street lighting was the same, although "no current had been used for the public lamps." Thus those who do not use the electric light are being made, through the charge for public lighting, to bear some of the expense of those who do. It is true the amount of the estimate is £300 less than the pre-war amount. When the motion as to the adoption of the estimate was before the Council, the voting was equal on an amendment that the Electricity Committee should bring up a more reasonable proposal. And this being so, the Electricity Committee are to be allowed to have the sum lifted from the pockets of ratepayers who are not receiving what they are paying for. This is municipal "fairness;" and a "side issue" of municipal trading. We should like to know what the Corporation would have said had a similar proposal emanated from the Gas Company.

Tar Nationalization in France.—The Syndicat Professionel in France has published the terms of the arrangement made by the Ministry of War for the compulsory delivery of all gas tar for the purpose of manufacture, by the Government, of explosives. All tar is supplied to distilleries sanctioned by the Government at the following prices per tonne, delivered free at the railway station or quay of the distillery: 56 frs. for deliveries in cistern trucks, 51 frs. in casks supplied by the distiller, or 53·50 frs. in casks supplied by the gas-works. The tars are not to contain more than 4 per cent. of water. These terms apply from March 1 last up to the end of the present year or, if the war should end before then, up to the conclusion of hostilities. Gas makers having to bear the cost of transport and the return of empties, each works arranges to send to the distillery nearest to it; and the Syndicat Professionel has drawn up and circulated particulars of routes and charges for the convevance of consignments and empties.

YORKSHIRE AND NORTH MIDLAND COALFIELD.

THE production of coal in the United Kingdom for the year 1913—before the war began to have its effect in reducing output—was 287,412,000 tons. To this quantity the three counties of York, Derby, and Nottingham—that is to say, the North Midland Coalfield—contributed some 74,195,000 tons, over 25 per cent. of the whole; the amount being made up as follows: Yorkshire, 43,671,000 tons; Derbyshire, 18,129,000 tons; Nottinghamshire, 12,395,000 tons.

The total quantity is so respectable that some consideration is warranted of the particulars of the coalfield concerned, given in a recent edition of a *brochure*, entitled "The Magnet of Commerce," issued by the Great Central Railway Company, and Dr. Walcot Gibson's Memoir "The Concealed Coalfields of Yorksbire and Nottinghamshire." The particulars, supplemented by information and data obtained from other sources, may prove of interest in view of the recent considerable colliery developments on the Eastern side of the field.

This sphere of mining operations is the largest in the British Isles, and was in 1905 estimated by the Royal Commission on Coal Supplies to cover some 4066 square miles, of which only 966 square miles were described as exposed—that is to say, worked—1200 square miles as the proved portion of the concealed coalfield, and 1900 square miles still to be proved. The latter figure has, due to the recent eastern development of colliery enterprize, been reduced by several hundreds of square miles, and the proved area thereby increased. With one foot as the minimum thickness of workable seams, and 4000 feet as the limit of depth for practical operations, the coal resources of this field were computed by the Royal Commission at approximately 26,500,000,000 tons for the proved district, and 23,000,000,000 tons for the concealed and unproved area, making a total of 49,500,000,000 tons, or 35 per cent. of the grand total for the United Kingdom of nearly 140,500,000,000 tons proved and unproved.

Taking the neighbourhood respectively of Leeds and Ilkeston as the north and south limits, and the Pennine Chain as the western boundary, the present Yorkshire and North Midland coal area on the east extends roughly to a line running from between Leeds and Selby, through Thorne and Retford, to Nottingham. The lowest coal-seams outcrop against the millstone grit on the west. The general dip of the strata is to the east, and the outcrops of the various coal-seems are encountered in ascending order until one passes from the exposed coal measures on to the permian, trias, and other formations which overlie them. There does not appear to be any decisive boring evidence that the coal area extends more than a few miles east of the Trent.

In the Yorkshire section of this important coalfield is found nearly every class of coal—covering house, gas, hard steam, engine, and coking coals. Messrs. A. Greenwell and J. V. Elsden, in their book of "Analyses of British Coals and Coke," remark on the general correspondence between the coal measures of South and West Yorkshire. Each has, besides many minor seams, three chief workable seams and two other important beds of a somewhat inferior quality. These are as follows: In South Yorkshire, the Barnsley, Parkgate, Silkstone, Swallowwood, and Thorncliffe thin seams; in West Yorkshire, Stanley Main, Haigh Moor, Middleton Main, Warrenhouse, and Beeston coals.

It is interesting, however, to note how the character of these representative seams changes according to district. The Barnsley seam is of chief importance in South Yorkshire. Its middle portion is of hard semi-anthracitic quality, used for steam purposes. The upper and lower parts are bituminous, and are good house coals. There are changes in composition of the seam in different districts, and even, it would appear, in different parts of the same colliery workings. In a southerly direction the Barnsley seam gradually loses the bituminous constituents, and becomes throughout a non-coking steam coal, known in Nottinghamshire and Derbyshire as "Top Hards." The lower part of the seam may consist locally of cannel, from 1 foot to 2 feet thick; the cannel constituent already showing itself in the pits in South Yorkshire. To the north, beyond Wakefield, the seam, under the name of "Warrenhouse," becomes split up by dirt partings, and loses its hard characteristic. The recent eastwardly development of the North Midland coalfield has been with a view to the winning of the Barnsley coal in South Yorkshire, and the Top Hards in Nottinghamshire and Derbyshire.

The next important coal bed—and in which the gas manager is much more keenly interested—is the Silkstone. This seam is fairly uniform in character, and is known in West and South Yorkshire, throughout Derbyshire, to Nottingham in the south. From Dr. Walcot Gibson's memoir it would appear that the seam is represented geologically, but by no means in quality, by Blocking or Barcelona coal in West Yorkshire. Towards the south of the field, numerous dirt partings also make their appearance; and for this reason the seam is generally known as Black Shale, and, less frequently, Clod coal. So far as West Yorkshire is concerned, however, the Middleton main is called the Silkstone of the district, and is regarded as a good house and gas coal. This bed has its representative further south in the Thorncliffe coal. The element of change is strongly marked in another coal of interest—the Parkgate. This is a valuable bed, recognizable over the whole field, but variable in thickness and quality, and liable here and there to "washouts." While a good gas coal in South Yorkshire, it tends to become only a second-rate steam coal in West Yorkshire, and is there probably represented by various seams, such as "First Brown Metal," "Old Hards," and "Third Brown Metal." In North Derbyshire its congener is the "Deep Hard." Haighmoor, in West Yorkshire, and Swallowwood, in South Yorkshire, appear to be related, or at any rate on the same horizon. Both are good house coals, and are used for gas-making purposes. They are represented in the Horbury district by Netherton thin and thick seams.

It is unnecessary to instance other coals lying above and below the important Barnsley strata. Some seams used for gas making are found only in one district—like "Kent's Thick" in South Yorkshire, the Flockton further north, and the "Black Bed" seams of the Bradford district and the neighbourhood of Leeds. While differences may occur in separate districts, it is well known that variations due to faulting may take place in colliery areas themselves, and upset generalizations as to the class of coal to be expected from any one source.

To readers of the "JOURNAL" primarily interested in gas coals, the question arises as to the prospect of increased supplies following the recent development to the east of the Yorkshire and North Midland coalfield. The purpose of the considerable colliery enterprise of the last few years is obviously to raise coal from the dominant Barnsley seam. This bed on the north-west, while varying in depth, is not far from the surface of the ground. Since the dip is to the east the depth increases, and the new pits, as in the Doncaster area, have to be sunk to depths amounting to 800 to 900 yards—one attaining indeed to 908 yards. Further to the east, at the Thorne Colliery, the Barnsley coal is reached at 916 yards; the seam being 9 feet thick, and in one undivided bed. A trial boring at South Car Haxey (eleven miles east of Doncaster) shows that the bed lies 1044 yards deep.

The Barnsley seam in the Doncaster district is about 9 feet to 10 feet thick, and consists of some 2 ft. 4 in. of hard steam coal, lying on a 2 ft. 6 in. bed of "Bottom Softs," classed as best house coal, and surmounted by some 4 to 5 feet (with a 6-inch break of "White Dirt") of second-class house coal, known as "Top Softs;" the latter, in its turn, being covered by "Tender Bind Roof." Both bottom and top softs are obviously bituminous, and are offered and used for gas-making purposes, though they cannot be said to rank with the best gas coals. Although there are two or three strata of coking and gas coals lying 70 to 120 feet above the Barnsley bed, and regarded by owners as suitable for both house and gas purposes, the interests of gas undertakings are in seams beneath this bed.

As examples of depth, above and below the Barnsley bed, thickness of seam, and district, the following gas coals, or coals offered for gas-making purposes, are taken from a general list of coals given by the "Magnet of Commerce."

Coal.	District.	Depth.	Thickness.
Aston Common	South-east of Sheffield	Yards above	
Melton Field .	"	175	3 to 4 ft.
Wathwood . .	Barnsley to Wakefield		
Woodmoor . .	" "		
Beamshaw . .	Barnsley	120	3 ft.
Kents Thick .	Sheffield and Barnsley	75	4 to 4 ft. 6 in.
High Hazel . .	South-east of Sheffield		
Barnsley Seam	South Yorkshire	Datum	9 ft.
Warrenhouse .	Wakefield District		9 ft.
Haighmoor . .	West Yorkshire	Yards below	
Swallowwood .	South "	70	3 ft. 6 in.
Flockton Thick	West "		3 ft.
Adwalton Stone	Dewsbury District	210	2 ft. 6 in.
Deep Soft . .	Derbyshire		"
Fenton . . .	Parkgate to Barnsley	225	3 ft.
Parkgate . .	South Yorkshire	250	4 ft. 6 in.
Thorncliffe Thin	Sheffield to Barnsley	280	2 ft. 6 in.
Middleton Little	Leeds District		
Middleton Main	" "	305	3 ft. 6 in. to 4 ft.
Swilley . . .	Barnsley		
Silkstone 4-Ft. .	"	330	4 ft.
Wheatley Lime	Wakef'd to Huddersf'd		3 ft.
Silkstone . .	South and West Yorkshire	360	4 ft.
Beeston . . .	Leeds and Wakefield		4 ft. 6 in. to 6 ft.
Shertcliffe . .	Dewsbury and Bradford	420	2 ft. 6 in.
Whinmoor . .	Barnsley and Penistone		3 ft.
Crow Coal . .	Leeds and Dewsbury	435	1 to 2 ft.
Black Bed . .	Bradford & Leeds District	450	1 ft. 6 in.

It can be seen, therefore, that the extra depth of (say) 250 yards necessary to reach one of the better gas coals, the Parkgate, in the eastern and new portion of the coalfield is scarcely likely to be negotiated, especially as the Barnsley seam is in itself sufficiently profitable. The importance and value of the latter has warranted the establishment of collieries on a large scale. Most of the new pits are designed to deal with outputs of something like a million tons per annum, and in some cases this figure may be exceeded. The existence of two shafts, each (say) 20 feet in diameter, and sunk to depths of 800 to 900 yards, and with extensive and well-equipped underground and surface plant necessary to raise 4000 to 5000 tons per diem, obviously entails considerable capital. There is, too, a period of two or three years constructional work, during which the capital earns no dividend. Still the very magnitude of the undertakings, aided by the thickness of the seam, may in normal times conduce to low working costs per ton of coal raised. What these were may be gathered from the following general example of costs per ton: Colliers' wages in

"getting" coal, 2s. 9d. to 3s.; hauling and winding (labour and power), 9d.; timbering, 5d. to 7d.; underground labour (deputies, enginemen, &c.), 1s. 6d.; overground labour (enginemen, general artisans, screenmen, &c.), 8d. to 1s.; stores (say), 6d.; management, rates, royalties, &c., 9d. These costs may be taken as approximately representative of conditions three or four years before the war (say, in 1910), when the average coal price at the pits for Yorkshire was about 7s. 6d. per ton.

A shrewd calculation of the rise in the wages of colliers and others, and of the increase in the price of material since that year, may perhaps suggest what present costs should be. The above figure is, of course, an average, and allowance must be made for varying conditions of pits generally. These conditions differ according to the age of the pit, depth and thickness of the seam, applicability of cutting machines, conveyors, and the like; but the trend of modern engineering developments in mines would be to reduce the cost of coal, were it not for the other tendency of labour charges to go up. But the latter is another story.

GAS WATER-HEATING APPLIANCES.

AN OPPORTUNE MOMENT FOR A FORWARD POLICY.

By Thos. Newton, of Hereford.

It is fairly obvious that a general high standard of excellence has now been reached by numerous manufacturers in the design and construction of various types of effective gas water-heating appliances suitable for all conceivable purposes. It is, therefore, clearly to the advantage of the gas industry that the results of so much applied science and technical skill should be turned to practical account. The gas profession is indeed fortunate in having at its disposal a body of competent and progressive manufacturers who are anxious not only to consolidate the good work already accomplished, and thus maintain the *status quo*, but who are also anxious and eager to turn to account every passing opportunity by originating and developing ideas of a practical character in the best interests of all concerned. Probably no other industry is so well served in this respect; and, as a direct consequence, the gas industry, in its continual and successful striving after greater and still greater efficiency in the design and construction of suitable apparatus, is thereby enabled to secure a splendid record of progressive development. While this is as it should be, it is extremely doubtful if the general public, or, for that matter, those who are, or should be, most intimately concerned, sufficiently realize the possibilities involved.

Nowadays, many preconceived ideas, wasteful habits, and old-fashioned customs are in the melting-pot, and slowly but surely undergoing a transformation. The resultant condition of affairs at once furnishes the opportunity for a forward policy in many directions, particularly as regards the installation of gas water-heating appliances. In this connection it should be borne in mind that this opportunity is not necessarily confined or restricted to large and important undertakings, since the prevailing favourable conditions are distributed throughout the country among large and small undertakings alike.

Ill-Designed Installations.

In every district the present inflated prices of domestic coal have necessitated the adoption of stringent economies in the use of it. To take but a single example, the familiar domestic coal-fired, hot-water system, with its range back-boiler, circulating pipes, and storage tank—seldom designed and fixed with a view to thermal efficiency—has suffered badly in consequence. That the system should practically break down in the presence of economy is indeed an eloquent commentary on its general inefficiency. During the summer months, in residences where the cooking is done by gas, it is sheer waste to burn coal under these conditions for the purpose of obtaining, after a prolonged interval, a limited amount of hot water. Questions are already being asked with increasing frequency and urgency as to whether it is expedient or desirable to stoke-up throughout the day for the sake of having a hot bath at night; and on the intelligent handling of these and similar questions much remunerative business to the local gas undertaking depends.

The foregoing is by no means an exaggerated representation of the existing state of affairs, as those with practical experience can testify. Quite recently the author came across two systems where in each case a 60-gallon storage cylinder was situated some 40 feet away from a comparatively small range back-boiler; and the system was so designed and constructed that the whole of the 60 gallons necessarily had to be heated before any hot water could be drawn off. One can readily imagine the waste and exasperation involved in obtaining a little hot water for dish-washing purposes, or sufficient hot water for a bath, in these circumstances in summer weather, especially when it is remembered that all the cooking is done by gas. In another particular case the "draw off" was connected to the flow pipe leading from the back-boiler to the storage cylinder, which was similarly situated. As a result of this arrangement, the hot water in the boiler had first of all to be drawn off—a negligible quantity for a bath—after which, of course, only cold water could be obtained at the hot-water tap.

While these unsatisfactory results might legitimately be attributed to deficiencies inherent in the systems under consideration, they may be regarded as general, inasmuch as many ill-designed and faulty coal-fired hot-water systems are inflicted on a long-suffering public throughout the length and breadth of the country. Their very existence proves the present contention of waste, which can be entirely eliminated by installing a suitable gas-heated apparatus. To obtain a real hot bath in the early morning by means of the coal-fired hot-water system (unless at the cost of great extravagance) is indeed a very doubtful proposition; but with a gas water-heater it becomes a mere matter of course.

Value of Expert Advice.

The certainty of obtaining an adequate supply of water that is really hot whenever it may be required is a point of great importance, and should be emphasized accordingly. In many instances this fact alone proves irresistible with consumers whose ultimate decision is given in favour of gas. In the selection of suitable apparatus expert guidance is essential, inasmuch as every case should be dealt with on its merits, and with due regard to all existing conditions and prospective requirements. The expert should be master of his subject. He should also be able to advise prospective customers generally as to the right type of apparatus that would suit a given set of conditions. Particularly should he be in a position to furnish definite information as to the consumption of gas, and the quantity of hot water of a given temperature obtainable; and, to inspire confidence, the results should—as they easily might—be guaranteed.

Whether a circulator can or cannot be advantageously fixed in connection with an existing system, depends on several factors—the size of the storage cylinder or tank, its relative position, its distance from the range boiler and circulator, and the general arrangement of the circulating pipes. Generally, it may be taken as an axiom that the shorter the circulating pipes—and, consequently, the nearer the storage cylinder is to the circulator—the more favourable are the prospects for gas.

Dealing with Existing Conditions.

Where the hot-water storage tank is fixed (say) in the roof, or at a considerable distance from the range boiler—and especially if it be fixed above all the hot-water taps—the excessive length of the circulating pipes makes it advisable to reconstruct the system before installing a gas water-heater. This reconstruction is of paramount importance, and should be insisted on in order to obviate all unnecessary consumption of gas which would occur through heat losses due to radiation. One method of carrying this into effect would be by altering the function of the existing hot-water storage-tank so as to make it an additional cold storage tank, and then interposing a gas-heated boiler and hot storage tank combined, near to, and somewhat above the level of, the range boiler. This would fundamentally alter the whole system, and incidentally enable the original circulating pipes to be utilized for a different purpose. Thus, one pipe could be made to serve as a cold supply to the new hot storage cylindrical tank, while the other could be utilized throughout its entire length as the exhaust, from which all hot supplies would ultimately be drawn. In these circumstances, the former circulating pipe, which has now become the exhaust pipe, would need to be disconnected from the original hot storage tank and then extended to the cold cistern, over which it should be bent, and thus terminate. In the event of the coal-fired range boiler being required for occasional use, either conjunctively or independently, a pair of circulating pipes would need connecting both to the range boiler and the gas apparatus.

The reconstruction detailed above was recently carried out in a residence where formerly it was necessary to maintain a large coal-fire practically throughout the whole of the day in order to obtain a hot bath at night. A hot bath in the morning was out of the question. The effect of the reconstruction resulted in the first hot bath being obtainable 25 minutes after lighting the gas under the boiler, and successive hot baths could then be obtained after intervals of 20 minutes. The average cost worked out at only $1\frac{1}{8}$d. per bath of from 25 to 30 gallons, with gas at 2s. 6d. per 1000 cubic feet.

Some tenants—and owners too for that matter—are extremely chary about having existing pipes and fittings altered, even to effect an improvement. Therefore, instead of attempting to modernize an existing system that is hopelessly obsolete, it is occasionally more practicable, and much more economical, to ignore it altogether by installing a combined gas water-heater and hot-storage cylinder and then laying fresh independent supplies to wherever the hot water may be required. This is a particularly feasible proposition where the old coal-fired system is obviously the worse for wear, and where the new apparatus can be conveniently fixed comparatively close to the bath room, scullery, and lavatory basin (for example), though not necessarily on the same floor as any of them.

As an illustration of what is meant, and as an indication of the excellent results obtainable under actual working conditions from quite a small apparatus of this description, the following may be mentioned: A 20-gallon size combined gas water-heater and hot-storage cylinder was fixed in the basement of a residence where an imposing coal-fired system utterly failed to yield even a tithe of the hot water that was constantly required. The flue was connected to an adjacent chimney breast, and hot water supplies were laid to three taps—two in a bathroom (one over a bath, the other over a lavatory basin) and one over a scullery sink, on the floors above. During a severe test extending over nine months this apparatus

never failed to yield whatever hot water was required, either by day or by night. During this period it supplied hot water for very nearly 3000 baths, at an average cost of 1·1d. per bath of 25 to 30 gallons, with gas at 2s. 6d. per 1000 cubic feet. On inspection, at the end of the period, the apparatus was found to be in perfect working order.

The Thermostat.

In order to obtain the most economical results from the type of apparatus under consideration, a thermostat is essential, since its function is to cut-down the consumption of gas automatically when the water becomes heated to a predetermined degree within certain limits. As a matter of fact, thanks are due to the thermostat for having made water heating by gas a practical proposition.

Advantages of Gas in Water Heating.

The benefits of heating water by gas are not confined to large households, since various types of gas water-heating apparatus are now available to suit all conceivable requirements. In premises which cannot boast of a circulating system, the geyser is a convenient means of obtaining unlimited supplies of hot water for both bath-room and scullery; while the domestic gas-heated wash-boiler has proved to be indispensable to many households. The incongruity of having coal, cinders, dust, and dirt about during the washing of clothing, table-linen, &c., only needs to be mentioned in order to be disparaged. A gas-heated wash-boiler is at once hygienic, clean, and serviceable. It is economical, inasmuch as the consumption of gas can be easily regulated to suit all immediate and ultimate requirements. Moreover, unlike the ordinary solid-fuel wash-boiler, it is absolutely dependable, while for efficient and uniform service it is unrivalled.

The business and professional man, no less than the domestic household, are nowadays effectively catered for, and a promising field for further prospective business thus awaits development. Never before has such an opportune moment as the present revealed itself, and never before were the omens of success so auspicious. Let it be remembered that there is a tide in the affairs of industries, as in the affairs of men, which, taken at the flood, leads on to fortune.

COKE AND COAL HANDLING MACHINERY.

Further Discussion on Mr. Lister's Paper.

In the "Journal" for April 4 a summary was given of the paper on "Modern Coal and Coke Handling Machinery," contributed by Mr. J. E. Lister at last month's meeting of the Society of Engineers; and in the following week's issue (p. 86) a report appeared of the discussion to which the paper gave rise. The issue of the "Transactions" of the Society that has subsequently been published records a written addition to the discussion that may be reproduced to make our notice of the proceedings complete.

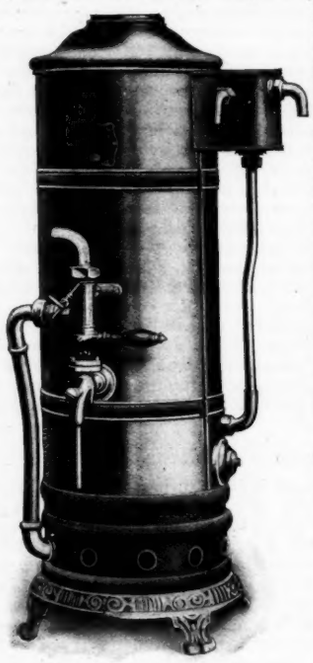
Mr. H. C. Widlake, of Plymouth, wrote to point out that no mention was made by the author of the paper of the excellent performances of the "D.B." separate projector and ram machines in regard to the time taken for the stoking of a retort. The figure would be well under a minute, which should create, Mr. Widlake considers, a favourable impression on prospective users of stoking machinery, as would also data concerning the number of retorts completely stoked by the expenditure of (say) one B.T.U. of electricity. In the case of the "D.B." separate machines, he imagined that one unit would amply suffice for the handling of seven or eight 20-feet through retorts. As to coal and coke handling machinery, he remarked: The use of electricity for operating same enables an invaluable check to be kept upon the general condition of the conveyor or elevator, as the case may be, by the use of integrating watt-meters on the respective motor circuits. No form of power application lends itself so aptly to this practice as does electrical driving; and the records obtained enable one to keep his finger on the pulse of the plant, so to speak, and to detect little incipient defects and fallings-off in efficiency, which, with any other form of driving, would have to develop to a serious extent before becoming apparent. Take the case of one of our drives for instance. We have a large conveyor of the push-plate type, on which we handle approximately 200 tons of coal per day; while our watt-meter shows a daily consumption of 70 units of electrical energy. Since the altering of the driving arrangements in this conveyor four years ago, the relation between the current used and the material handled has been most consistent; and any mechanical defect in the conveyor chain or driving head invariably shows itself in the figure representing "coal handled per unit of electricity"—usually 3·5 tons. We do not regard the check as most valuable in regard to the motor, but rather in regard to the mechanical arrangement of the conveyor; and it has enabled us on many occasions to detect incipient faults and apply the stitch in time. The same argument may apply to all the machinery on a gas-works. The initial expense of such meters is but trifling as compared with the benefits which accrue from their use. In conclusion, he says: English gas undertakings, as a whole, are rather slow to take advantage of this characteristic of the electric drive, and regard such meters as being more ornamental than useful. On the Continent, on the other hand, I believe their value is fully appreciated; and in some works they form a standard portion in every power drive.

Mr. Lister, in reply to Mr. Widlake's remarks, wrote that he agrees that electrical records of the kind mentioned are often extremely useful as a check on the correct working of the plant. He finds from his records that the average current taken by a combined charging and discharging machine is about 12 to 15 ampères at 220 volts, which will give approximately nine retorts charged and discharged per unit. If the power is generated on the works by means of a gas-engine, the cost of generating current, taking gas at cost in holder, will be about 0·75d. per ton of coal carbonized, including also the breaking and elevating of the coal. It is extremely useful, Mr. Lister points out, to have some record of the power required, as this certainly affords a very good check on the working of the plant; and, as mentioned by Mr. Widlake, electrical drives offer considerable advantage in this respect. It is good practice to fit an integrating watt-meter, or some similar instrument, on the main switchboard.

PARKINSON'S "COUNTER" BOILER.

There is at the present time, owing to pressure of work in the munition factories throughout the country, an altogether exceptional demand—in addition to the usual requirements in hotels, restaurants, schools, mess-rooms, &c.—for ample and prompt supplies of boiling water for tea-making and similar purposes; and gas is unrivalled as the medium for meeting both ordinary and extraordinary needs in this respect. To the appliances already on the market designed for the use of gas for the purposes indicated, the Parkinson Stove Company, Limited, of Birmingham, have now added their patent "Counter" boiler, which possesses several features to recommend it.

By means of a specially designed dual tap, both gas and hot water are turned on or off by the movement of one lever. The cold water passes automatically through a float valve, and is boiled as it flows through the apparatus; and when the gas is turned off, a by-pass to the burner keeps the water hot, ready for instant use. It should be added that the boiler can, if desired, be had at some reduction in cost with independent gas and hot-water taps, operated separately, instead of the dual tap. Cleaning is a simple matter—in fact, it would seem that "Simplicity" has been one of the aims in designing the appliance. To get at the interior, it is only necessary to lift off the loose cover—deposits being removable through plugs at the bottom. Beyond this, the particular joint employed permits the parts to be entirely separated for more effective cleaning. As to performance, the consumption of gas is said to be about 3½ cubic feet per gallon of boiling water; and within five minutes of first lighting the gas, boiling water is ready, after which the flow is continuous and unlimited. In another form—the patent "Counter" duo-boiler—provision is made for storage in a container in which the water is accumulated and kept boiling by a small gas-burner, so that the entire contents are available for instant use. The container can then be refilled in a few minutes by turning on a tap connecting it with the boiler. The advantage in many situations of having such a reserve will be readily understood. Both forms of apparatus are of the substantial design which characterizes the goods manufactured by the Parkinson Stove Company (which incorporates Maughan's Patent Geyser Company).



Manchester and District Junior Gas Association.—On the invitation of Mr. J. G. Newbigging, M.Inst.C.E., members of the Association will next Saturday visit the Bradford Road station of the Manchester Corporation Gas Department, to inspect the new retort-house and the toluol and acid-concentration plants so successfully working there. Later in the day a general meeting of the members will be held to consider a proposal from the Council as to the resumption of the Association's proceedings—broken off soon after the outbreak of the war. A "Social Evening" will wind-up the day's engagements.

THE APPLICATION OF ELECTRICITY TO EXHAUSTER DRIVING.

By H. C. Widlake, M.J.Inst.E., of the Plymouth and Stonehouse Gaslight and Coke Company.

(*Concluded from p.* 175.)

In this last instalment of his article, the author proposes to show three different methods of coupling exhausters for electric operation; and he will also deal briefly with these methods and their relative advantages. In each case it will be assumed that the motors are 10 B.H.P. machines, and the exhauster speed is 110 revolutions per minute.

In fig. 1, the motor is shown coupled to the exhauster by means of a single reduction spur gearing. The pinion on the armature shaft may be either of steel or of reinforced fibre or paper. This latter class of pinion is rapidly coming into favour for high-speed drives, and gives very silent running. When all metal gears are used, the train should be enclosed in a good light steel gear case,

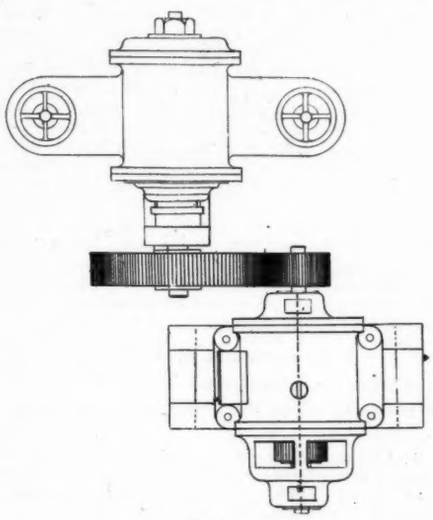


Fig. 1.

the lower portion of which forms an oil-bath in which the teeth dip, thus ensuring a plentiful and entirely automatic supply of lubricant. This arrangement allows of a fairly high speed—say, 600 to 700 revolutions per minute—and hence a moderate priced motor being used; while it is an easy matter to change a motor if necessary.

In fig. 2 the motor is shown coupled to the exhauster by means of a Hans Renold silent chain drive, which, as in the case of fig. 1, permits of a moderate priced motor being employed, and at the same time allows of a much greater distance being maintained between the respective driving centres of the motor and the exhauster than could be negotiated by means of a single spur gear.

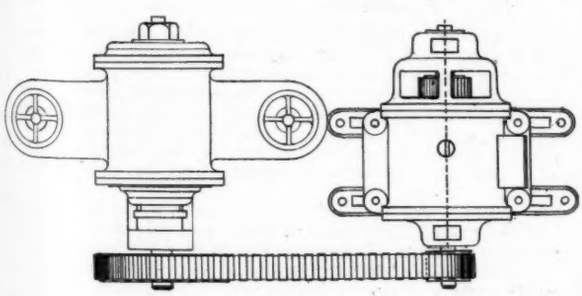


Fig. 2.

As in the previous case, the chain and its sprockets should be run in an enclosed oil-bath. This arrangement is very flexible; and the motor being mounted on slide-rails, the chain can be easily adjusted for tension, even when the set is running.

The arrangements outlined in figs. 1 and 2 are pretty much on a par as regards simplicity and efficiency; their respective advantages depending upon the nature of the space provided for, and the general surroundings in which it is desired to instal the exhauster set.

In fig. 3 an arrangement is shown whereby a high-speed, and hence a comparatively cheap, electric motor can be employed to drive a comparatively slow-speed exhauster. The set comprises the motor direct-coupled to a reduction gear-box on a combination bed plate, the end of which lines-up with, and is bolted to, the bed of the exhauster. While this arrangement allows a cheap motor to be used, it has little to recommend it, in view of the fact that any saving in the first cost of the motor is more than swallowed up by the cost of gear for reducing the high motor speed down to the figure at which it is required to drive the exhauster. As in

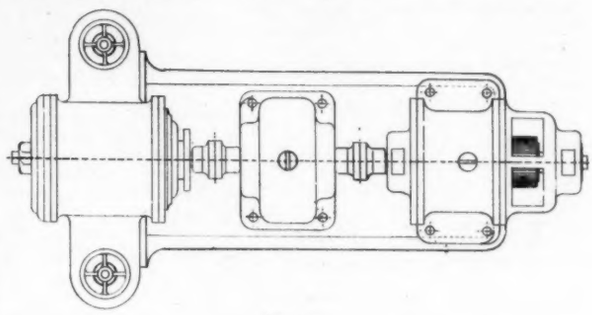


Fig. 3.

the case of the steam-driven exhauster, on comparatively large works the dictates of prudence would demand that the exhauster sets, complete with their control gear, should be laid down in duplicate; each set being capable of dealing with the maximum make at the heaviest part of the season.

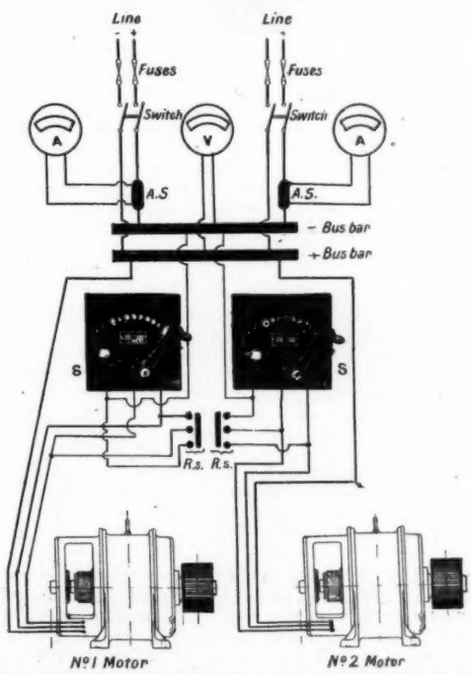
In an installation comprising two separate and distinct sets of exhausting plant arranged in accordance with either figs. 1, 2, or 3, the following points constitute, in the writer's opinion, small factors in design which, although not expensive in themselves, will contribute largely to the maintenance of the plant in an efficient condition, and will insure it to a great extent against electrical troubles:

1.—The feeders to the exhauster control gear from the generating station bus-bars should be in duplicate, and should be each capable of carrying the current required for the operation of both exhausters, should it ever be necessary to run both at the same time.

2.—On arrival at the exhauster control board both feeders should be taken through fusible cut-outs and on *vid* double pole switches to a small pair of bus-bars, from which the control gear would derive its supply. This arrangement would permit of the feeders being used either singly or in parallel, and would allow of the fuses being withdrawn, for either examination or rewiring, without interrupting the supply to the running set.

3.—The two starters should be each supplemented by a "running" switch, the function of which should be, when closed, to reproduce the electrical conditions made by the starter on its last notch. The closing of this switch would permit of the working starter being disconnected and removed, changed, repaired, and replaced without stopping or changing-over the exhausters.

The conditions outlined under these headings are shown diagrammatically in fig. 4, in which an exhauster switchboard, complete with fuses, meters, switches, starters, and running switches is shown connected down to two exhauster motors.



A. Ammeter. AS. Ammeter Shunt. V. Voltmeter. S. Starting Switch. Rs. Running Switch.

Fig. 4.

The provision of exhauster sets in duplicate, and the arrangement of control gear outlined above, would seem to give an ample degree of protection against the possibility of stoppage due to mechanical or electrical troubles. But with such an installation it would certainly be advisable to keep a spare motor ready to put into place at the shortest notice. With this possible necessity in view, a joist should be thrown across the roof principals above each exhauster set in such a position as to permit of a motor being exchanged with the least possible loss of time due to rigging tackle.

By the use of modern clutches and a suitable lay-out of modern chain gearing, it would be quite possible to so arrange the plant as to permit of either motor driving either exhauster and of changing-over either motor or either exhauster without stopping. But taking all things into consideration, it is doubtful if any real advantage would accrue from so elaborate a lay-out. In the first place, it would involve the continuous running of a lot of extra gearing, and, secondly, would place the entire plant at the mercy of the single transmission system.

Governing.

Where the bye-pass compensator method is employed for the regulation of the pull, there is no occasion to provide for any automatic regulation of the motor speed, which may remain constant as in the case of the gas-engine driven exhauster. Rheostatic hand control of the speed may, however, be provided. When, on the other hand, the method of regulating the pull by the automatic variation of the speed of the exhauster is favoured, the bell governor previously employed in connection with the steam-engine drive constitutes in itself an automatic element, and could be coupled-up to a suitable shunt regulator in much the same manner as it was previously connected to the balanced throttle valve.

A suggested arrangement in this connection is shown in fig. 5. By means of a hand rheostat the speed of the set could be brought to a suitable figure, after which the motor could remain in charge of the automatic element, which, by altering the resistance in the field windings, would increase or decrease the speed, according to the position of the governor bell. The ordinary type of shunt-wound motor with interpoles lends itself to a speed regulation of (say) 20 to 30 per cent.; but special variable speed motors, having a speed ratio of 1 to 4, obtained solely by field regulation, are commonly used.

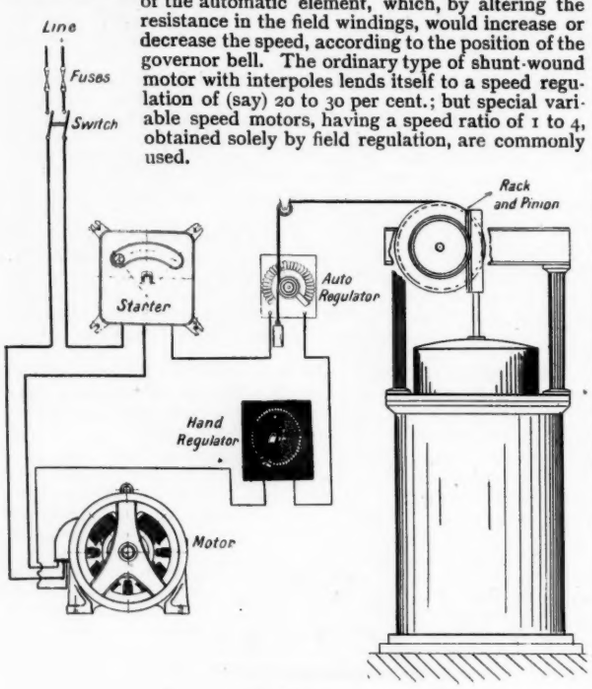


Fig. 5.

Type of Motor.

As has been mentioned, the shunt-wound variable speed motor is particularly suitable for this class of work. It is highly desirable that a totally enclosed gas-tight motor should be employed; and bearing in mind that the great majority of electrical troubles are due to under-rating, it is essential that this motor should be master of its work, and of a capacity which will permit it to operate continuously without any undue overheating. While the arrangements for rendering it gas and flame tight should be efficient, it is important that the general design of the machine should be such as to permit of a thorough daily inspection, allow easy access to the commutator and brush gear, and ample facilities for blowing-out and cleaning.

In conclusion, the author desires to make it quite clear that he does not mean these notes in any way to represent standard practices in connection with the electrical operation of exhausting plant; his intention being to simply indicate the general conditions which, in his opinion, have to be fulfilled before the electric motor can be successfully applied for this purpose, as the subject is one on which there is very little available data—exhausting plants driven in this manner being at the present time comparatively rare.

COKE-OVEN MANAGERS' ASSOCIATION.

Visit to the Tinsley Park Colliery Coke-Ovens.

The first works visit of the Coke-Oven Managers' Association took place last Saturday, when a party of members numbering between forty and fifty took advantage of an invitation by the Tinsley Park Colliery Company, Sheffield, and Mr. T. N. Riley, the Coke-Oven Manager, to inspect the coking plant attached to the collieries. Three parties were formed, under the guidance of Mr. Riley, Mr. J. F. Atkins (Assistant Manager), and Mr. J. Dowson (foreman).

The plant comprises a battery of forty Koppers regenerative ovens, and coal washing and bye-product plant for tar, sulphate, and crude benzol, designed to treat the gases from fifty ovens. The sulphate manufacture is by the "semi-direct" process. The coke-ovens of this plant were ready to start in August, 1914; but, owing to the war, the heats were reduced, and the plant did not start until the October of that year. The washery—which was particularly admired by the visitors—has a capacity of 75 tons of rough slack per hour. A particular feature in the washery is the extraction of the dust in the dry state before washing—being afterwards mixed with the washed coking slack. The total amount of coal treated to the date of the visit had been 233,000 tons. The free coal in the dirt was stated to be 0·5 to 1 per cent., and the free dirt in the coal 2 to 3 per cent. In the washery there are four drainage bunkers for the uncrushed slack, of a capacity of 150 tons each, and the service bunker for supplying the ovens has a capacity of 600 tons. Slurry troubles were eliminated entirely by the taking-out of the dust. The output of coke per hour was declared to be 31 tons; the percentage of breeze being 1½ per cent. on the coke made. The yields of bye-product are: Sulphate, 31 lbs. per ton of dry coal; tar, 10½ gallons per ton; benzol, 2·40 gallons per ton. The surplus gas is used for generating steam in two gas-fired boilers for the bye-product plant; the remainder being sent forward, by means of a Bryan Donkin "booster," to four Lancashire boilers at the colliery.

Tea at the Miners' Institute.

After the inspection, which extended over two hours, the visitors were the guests at tea of the Tinsley Company at the Miners' Institute.

Mr. J. A. Lee moved a vote of thanks to the Tinsley Company, coupling with it particularly the name of Mr. Laverick, the Managing-Director, and to Mr. Riley. This was the first occasion of the kind in the career of the Association; and from what he knew of such gatherings in connection with a kindred association, he was quite sure that such visits, if more of them could be arranged, would bring to the members more opportunities of gaining knowledge than all the papers and essays which could be given to them by either practical coke-oven men or professors of science during the winter months. The plant they had seen was one which showed clearly that it was managed in a most able manner.

Mr. John Davy (Grigglestone) seconded the motion, which was carried unanimously.

Mr. Riley, in a brief reply, said that in regard to the cleanliness of the plant, it was kept always in practically the condition in which they had seen it that day. There was no doubt that the cleaner a plant was kept the more comfortable were the workmen, and the better they would work.

THE BUSINESS MEETING.

Formation of Local Sections.

In the evening, a business meeting of the Association was held at the Hall of Applied Science, Sheffield University, Mr. George Chrisp, the President, occupying the chair.

In accordance with an instruction by a previous general meeting, the Council had prepared, and now submitted, a scheme for the splitting-up of the Association into district sections.

The President introduced the scheme, and announced that several amendments had been received from the Staffordshire members.

The scheme was then considered clause by clause—slight amendments being introduced. The Council were authorized to form a branch or local section whenever at least five full members of the Association (as distinct from associate members), residing in, or otherwise identified in interest with, a locality, make application to the Council, signed by such members, to cause a local register to be made. If the Council consider that the formation of such a local section is likely to further the interests and objects of the Association, they may require the signatories to form a provisional local committee and submit draft rules under which the section is intended to be conducted, and may provisionally approve such rules, with any modifications they may think fit. A Committee and officers may then be elected at a meeting to which all the signatories have received written invitation; and for such meeting to be valid the majority of members present must be full members. The local section would then be deemed to have been constituted, and the rules as drafted adopted.

This clause was finally agreed upon.

The Chairman said that, in connection with the adoption of rules of a local section, the Staffordshire members proposed a reservation that the rules, as laid out by the Council, be accepted, but with the addition of a definite understanding that the chemist

of a coking plant be admitted as an associate member, irrespective of age—the present constitution of the Association precluding the admission of any man under 21 years of age.

Mr. MYERS said there were cases in the industry in which the chemist of a coking plant did not happen to have reached the age of 21 years; and it was very hard that such a man, who must be capable to occupy the position, should be debarred from membership merely because of his youth.

Mr. B. W. HAIGH objected, on a point of order, that the proposal would mean a great change in the Association's constitution, which could not be carried out until the annual meeting.

Mr. MYERS contended that, by this scheme of local sections, the constitution was already being altered.

The PRESIDENT remarked that this was only so in regard to the establishment of branches.

Mr. W. GREEN said he felt a man ought to be of age before being admitted to the Association.

Mr. HAIGH said he took it the local section could draw up its own local rules, according to the scheme, and that if they chose to admit a young man under age he might be a member of the local section, though not of the Association proper.

The HON. SECRETARY (Mr. J. T. Price) said he entirely differed from Mr. Haigh in this respect.

Mr. MYERS said he did not think any man should be a member of a branch who was not a member of the Central Association.

Ultimately, the proposed addition, as to admitting chemists under 21 years of age, was not accepted. It was agreed that the rules of a local section should contain the following provisions:

> (*a*) That the business of a local section shall be conducted by a Committee chosen from members of the section, consisting of Chairman, Hon. Secretary, and not less than three other members; the Chairman and Secretary to be full members of the Association. (*b*) Anyone whose name appears on the Association's current list of members, whether resident at or otherwise interested in the place where the local section is constituted, shall, upon application to the Hon. Secretary, be entitled to have his name entered on the register without any entrance fee, and to become, and remain, a member on the payment of the annual subscription, and without having to submit to re-election. (*c*) Amendments in, alterations of, or additions to, the rules of a local section shall be submitted to the Council, and shall not become operative until they have been approved.

In regard to finances, the PRESIDENT said there was a proposed amendment by the Staffordshire members that the representative of a branch on the Council should have his travelling expenses paid out of the general funds of the Association.

The HON. TREASURER (Mr. Haigh) said that when the Council drew up its suggestions it was thought that it would be extremely probable that branches would wish to pay their delegates' travelling expenses, and therefore provision had been made that 25 per cent. of the funds paid to the Council should be refunded for this purpose. He thought the rule as proposed by the Council would quite cover what Mr. Myers had in mind.

Mr. MYERS said that, during the course of the meeting, he had been thinking that, so far as they of Staffordshire were concerned, they were that evening probably doing a lot of unnecessary work. There was undoubtedly, in the wider areas, a feeling that the whole method of government of the Association ought to be altered. He was afraid that when the Staffordshire members drew up their amendment they had this in mind, rather than merely forming branches on the basis of the present constitution. He believed he would be interpreting the feelings of his Staffordshire colleagues if, in the circumstances, he withdrew the Staffordshire suggestions entirely.

The PRESIDENT said Mr. Myers was quite at liberty to do so; but, as a matter of fact, the Council had had in mind the very circumstances Mr. Myers had suggested.

Mr. MYERS said they in Staffordshire had already spent a considerable amount of money; and these expenses had so far been shared by the members of the district. When they drew up their amendments to the Council's scheme, it had not been their intention to force them on members against their will. It would be better that they should be withdrawn than ruled-out on points of order.

Mr. J. A. LEE said he hoped the Staffordshire members would bear in mind that the Association was new and inexperienced. Personally, he felt that the Council had been very willing to stand aside, and ready to see that any of the things which they did in the early days were amended in the interests of the members generally. He felt that the scheme before the meeting was on right lines.

It was agreed that, for defraying the expenses of a local section, the Council may require that all members thereof should pay a small annual subscription, the expenses of the section to be defrayed out of the sectional subscriptions; but the Council, at its discretion, may defray the whole of these expenses up to 25 per cent. of the subscription income derived from the section, out of the general funds of the Association.

PUBLICATION OF COMMUNICATIONS.

An animated discussion took place on the question of publication of papers or essays. It was ultimately agreed that this must depend on the wishes of the Council, subject to those of the author.

With the exception of those already adopted, the Staffordshire amendments were withdrawn by Mr. Myers.

REPRESENTATION ON THE COUNCIL.

It was agreed, after some opposition, that the chairman of every local section should be an *ex-officio* member of the Council during his term of office, and that where a section had at least twelve full members, the Hon. Secretary also be *ex-officio* on the Council, and that sections be further entitled to elect one additional representative for every additional ten full members, and that only full members could be appointed to the Council.

An important restriction on publication of transactions which was adopted was that neither the local section committee nor any meeting of the section shall cause to be published any notice upon any matter or subject, either in the name of the Association or of the section, to the general public. All such notices or communications necessary or desirable to be made, and all correspondence between a local section and any corporate or public body or other society—except that it relate wholly to the ordinary business of the local section—shall be conducted through, or be subject to the sanction of, the Council.

In a further clause provision was made for the closing-down of a section if required.

CONTROL OF THE ASSOCIATION.

The HON. SECRETARY gave notice of motion that at the next meeting the Association discuss: "That the present system of control of the Association—that is, by a Council of five members together with the President, Treasurer, and Secretary and a co-opted member from each area—be altered, and that the so-called parent body become a branch, and that a General Council be formed for the whole country, made up of representatives from different areas in proportion to the strength of the branches, this to take place at the annual meeting."

THE NEXT MEETING.

The CHAIRMAN announced that the next gathering would be on Saturday, the 27th inst., when there would be a visit to the Waleswood plant in the afternoon, and a meeting in the evening.

LONDON AND SOUTHERN JUNIOR ASSOCIATION.

An Evening with the Lantern.

When the programme for the current session of the London and Southern District Junior Gas Association was being compiled, Mr. J. G. CLARK, of the Gas Light and Coke Company—whose previous contributions to the "Transactions" have been greatly appreciated by the members—was asked if he would undertake to fill a vacant date. Under the existing strenuous conditions, he felt unable to promise a paper, but suggested for the Council's consideration that there should be an evening devoted to the exhibition of lantern slides dealing with technical matters of concern to the Association. The Council fell in with the proposal: and, as the result, a meeting was held last Friday evening at the Westminster Technical Institute, at which Mr. Clark, with the aid of a first-rate selection of lantern slides loaned to him from various sources, delivered a lecture that was of real interest to his audience—which, however, was unfortunately smaller than the occasion warranted.

The first series of slides which were thrown on the screen had reference to some phases of lighting—particular attention being drawn to certain illustrations relevant to factory and workshop lighting. There were shown two workshops of similar size, and used for the same kind of work—carpentry and joinery. One was equipped with upright incandescent burners, well shaded; while the other was fitted with the inverted system. Mr. Clark remarked that, from the point of view of adequate and suitable lighting, both installations might be regarded as satisfactory. The illumination was nearly the same in each case; but the economical aspect of the inverted system was revealed by the following experimental data. The difference in gas consumption which would be observed might be regarded as the practical advantage of the inverted over the upright system of lighting.

—	Illumination on Benches.			Gas Used per Hour per 100 Sq. Feet of Floor.
	Max.	Min.	Average.	Cubic Feet.
Inverted, with opal shades	5·4	3·6	4·5	3·78
Upright, with squat globes	5·0	4·0	4·4	5·85

This led to a reference to the report issued some short time ago by the Home Office Committee on Factory Lighting, which was dealt with at length in the pages of the "JOURNAL." The report, said Mr. Clark, had created an immense amount of interest among those connected with the lighting industry; and its influence would, he thought, be found to prove very beneficial in the practical management of industrial concerns. The factory manager did not always look with favour upon a Government measure for the control of works equipment; but respecting the particular question of lighting, he believed the recommendations of the Committee would ultimately prove beneficial alike to the employer and the employee, and therefore also to the community at large. Some slides were then shown in support of the contention that the enormous amount of light which is now wasted by the non-use

and misuse of suitable reflecting shades means that, on the whole, better illumination will often be found to be consistent with reduced costs for lighting, irrespective of the nature of the illuminant used.

Next the audience had their attention drawn to some excellent installations of school lighting. It was pointed out that in planning these installations, the objective was to provide an adequate, and as nearly as possible uniform, illumination in such a way as to prevent direct vision of the mantle by any of the scholars sitting at the desks. The figures quoted as the foot-candle values found on the different desks in the room (which was arranged to accommodate sixty scholars) varied from 3·2 to 5·5. This matter led on to consideration of glare and shadow effects; illustrations being shown which demonstrated the disadvantage of generalizing too much, as they indicated that what is bad under one set of conditions may be good under another. The relatively lower shadow densities produced by indirect and semi-indirect methods of lighting, as compared with direct methods, remarked Mr. Clark, serve to emphasize the importance of proper spacing of direct units so that their shadows "kill each other." He added that, in considering the relations between direct and indirect lighting, it must be remembered that, even under favourable conditions with light-coloured walls and ceilings, indirect lighting is about twice as expensive as direct; the semi-indirect system occupying about a midway position. If the ceiling is not light coloured, the relative inefficiency of indirect and semi-indirect methods, as compared with direct lighting, is still greater. This fact must be borne in mind in framing specifications for interior lighting.

The almost endless number of ways in which light from gas mantles can be directed, were illustrated by a series of slides showing the polar distribution of radiation. In addition to the lighting ones, there were others dealing with heating units; and these latter, the lecturer said, served as a reminder of the developments in the gas-fire during recent years. By varying the contour of the radiating surface, and by using reflectors, some variety has been made in the form of the distribution curves. In this connection, it was interesting to note that the calculated distribution curve for a symmetrical and perfectly flat incandescent surface is a circle having a zero value directly sideward and a maximum value directly forward. The circle therefore serves as a basis in indicating the distributory advantage arising from any particular contour of fuel, or from the use of a reflector.

A brief description of the Forbes water sterilizer (which being recuperative requires only a little more than 2 cubic feet of gas for the sterilization of a gallon of water) was followed by a set of slides illustrating some aspects of air pollution. Bearing on these, mention was made of the recent report in the "Lancet," detailing the results of an investigation extending over a large area of the country, and providing valuable data regarding the nature and amount of the pollution of the air in industrial, residential, and country districts. After the war, it was hinted, we shall probably more fully appreciate the wastefulness of our present methods of consuming coal, and give more attention to "burning our smoke." Turning to another matter, Mr. Clark remarked that the efficient ventilation of gas appliances is an important subject, apart from the ventilation of the places in which they are used. Some useful information on this subject was provided in the last report of the Ventilation Committee of the Institution of Gas Engineers. The lecturer has noticed in some types of lamp, particularly of the outdoor pattern, that it is not always realized that air-currents, like everything else, choose the path of least resistance, which may not be the right one. There was an illustration of a defect of a kind which can easily be overcome by making the correct course for the air-stream the easiest; and it was pointed out that insufficient aëration of a gas-lamp reduces the temperature of the flame, and therefore the incandescence of the mantle. Quoting some observations made by Franklin nearly 160 years ago, referring to the oil-lamps of his time, Mr. Clark said that Franklin appeared to have been the first to observe that an inlet implies an outlet, and *vice versâ*, and that either without the other cannot effectively exist. Yet one frequently sees workshops and other places provided with ample outlets for foul air, but with no inlets for fresh air. Franklin was disclaiming the credit for having introduced public lighting into Philadelphia, but stating that he had devised a lamp differing from those supplied from London. Regarding the London-made lamps, he said:

> They were found inconvenient in these respects: They admitted no air below; the smoke therefore did not readily go out above, but circulated in the globe, lodged on its inside, and soon obstructed the light they were intended to afford, giving besides the daily trouble of wiping them clean; and an accidental stroke on one of them would demolish it, and render it totally useless. I therefore suggested composing them of four flat panes, with a long funnel above to draw up the smoke, and crevices admitting the air below to facilitate the ascent of the smoke. By this means, they were kept clean, and did not grow dark in a few hours as the London lamps do, but continued bright till morning; and an accidental stroke would generally break but a single pane, easily repaired. I have sometimes wondered that the Londoners did not, from the effect holes in the bottom of the globe lamps used at Vauxhall have in keeping them clean, learn to have such holes in their street-lamps. But these holes being made for another purpose—viz., to communicate flame more suddenly to the wick by a little flax hanging down through them—the other use of letting in air seems not to have been thought of; and therefore after the lamps have been lit a few hours, the streets of London are very poorly illuminated.

The following passage by Franklin was also quoted, as showing that he had anticipated the daylight-saving idea, which now again is so frequently made mention of:

> In walking through the Strand and Fleet Street one morning at 7 o'clock, I observed there was not one shop open, though it had been daylight and the sun up above three hours—the inhabitants of London choosing voluntarily to live much by candle light and sleep by sunshine, and yet often complain a little absurdly of the duty on candles and the high price of tallow.

Recently, while interested in the question of lead covering of iron plates, and considering possible means of covering the raw edges of the lead-covered plates, so as to prevent corrosion of the iron, Mr. Clark came across a description of an apparatus, a picture of which was thrown upon the screen. The system consists of the hurling of a stream of atomized molten lead against the plate at such a rate that a uniform coating of the lead is produced—thus resembling mechanical painting—and gas with air-blast is employed as fuel. The final matter to be touched upon was the movement of materials in their passage through hoppers. An illustration taken from the "Génié Civil" (where it was stated that the movements of the material remain very much the same, even for very acute and very obtuse angled hoppers), showed a series of conditions indicating that the material, in passing through the hopper, does not slide against the side, but simply falls away from it towards the crater which forms in the centre of the mass of material—the depth of the crater depending, of course, upon the angle of repose of the material.

Mr. Clark distributed among his audience a number of pamphlets bearing on the questions to which he had drawn attention, and acknowledged his indebtedness, for being in a position so to do, to the British Commercial Gas Association.

The PRESIDENT (Mr. S. B. Chandler) remarked that they were very much indebted to Mr. Clark for coming and sharing with them some of his knowledge, and for showing them so excellent a series of slides. They saw that the application of gas to lighting, &c., had reached a scientific stage, and that it was not merely a question of going into a building and putting up a burner, but certain principles had to be thought out and circumstances considered, in order to obtain the maximum efficiency.

Mr. F. AINSWORTH said that, in connection with semi-indirect lighting, he had found dust accumulated very soon in the bowls; and he thought it would be well if means could be provided for its egress without interfering with the lighting. Reference had been made to a church lighting installation which had been changed from the upright to the inverted system, which gave shadows. This trouble could easily have been got over, if they had adopted a swan-neck fitting, giving a light upwards as well as downwards. The same thing applied to houses. With the swan-neck or angle arrangement, one could get over difficulties which it was not possible to surmount with vertical burners. He would like to see the gas profession give more attention to swan-necks and angles, and manufacturers turn out more fittings to suit them.

Mr. CLARK replied that, of course, dust was a trouble with the method of lighting referred to; and some fittings were made with a dome-shaped cover over the top. Suitable provision had to be made for ventilation. As to church lighting, apparently what Mr. Ainsworth had suggested met the difficulty in the same way as the upright system.

Mr. F. J. PEARCE (Senior Vice-President) proposed a hearty vote of thanks to Mr. Clark for his lecture, coupling with it the name of Mr. Goodfellow, the custodian of the building, who had manipulated the lantern.

Mr. W. L. WESTBROOK, who seconded, said he hoped complete success would attend the efforts to induce makers to use wherever possible diagrams of illumination, distribution curves, &c. It was vital to the gas industry, if they were to hold their own, to take up this aspect of the question. It seemed to him that the use of the Holophane "Lumeter" should become more general. No doubt, as things were, larger units than necessary were sometimes installed, and the consumer put to unnecessary expense.

The vote was heartily carried; and Mr. CLARK briefly acknowledged it.

British Industries after the War.—The President of the Board of Trade has appointed two further Committees to consider the position of certain branches of British trade after the war, with special reference to international competition, and to report what steps (if any) are necessary or desirable in order to safeguard this position. One of these Committees is for the textile industries, with Mr. Henry Birchenough as Chairman; and the other for the electrical trades—the Hon. Sir Charles A. Parsons, K.C.B., F.R.S., Chairman.

Eastern Counties Gas Managers' Association.—Members of the Association will assemble at 11.30 a.m. on Friday, the 12th inst., for the annual meeting, at the High Road offices of the Tottenham District Light, Heat, and Power Company, when the President (Mr. A. E. Broadberry) will deliver his Inaugural Address, and a paper will be read by Mr. J. Terrace, of Grimsby, entitled "The Control Book." At the conclusion of the business of the meeting, there will be a visit to the stove-repairing shops, and afterwards luncheon in the offices, on the invitation of the Chairman and Directors of the Company. The afternoon will be devoted to a visit to the gas-works, where tea will be served.

DETERMINING BENZENE, TOLUENE, AND SOLVENT NAPHTHA IN LIGHT OILS, &c.

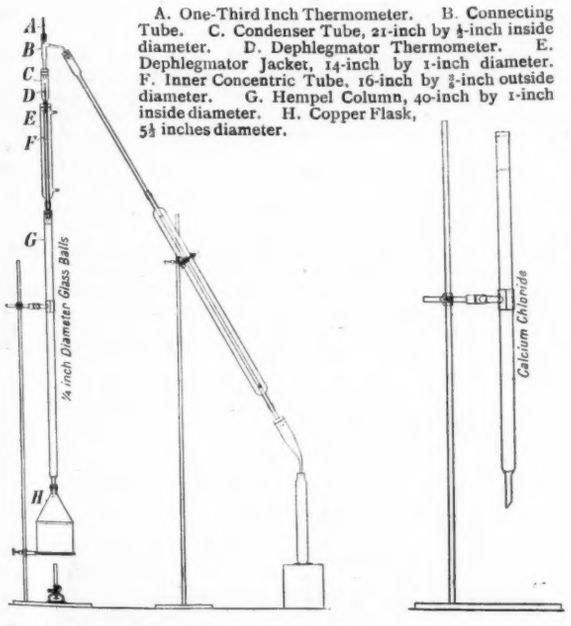
The unusual demand created by the war has led to the development of a practical method for determining the benzene, toluene, and solvent naphtha content of light oils, &c., which forms the subject of an article, appearing in a recent number of the "Gas Record" [Chicago], by Mr. Dyke Wilson and Mr. Ivan Roberts, Chemists of the Laclede Gas Company, of St. Louis, U.S.A.

The authors pointed to the fact that the importation of the above-named residuals into America has been discontinued, owing to the fact that the warring nations are using an unusually larger amount in their own countries. Benzene is needed as a solvent in many industries for the production of chemicals, drugs, and dyes, while toluene is needed by the munitions manufacturers for the production of high explosives.

To meet the unusual demand for these oils, plants have been installed to recover from coal gas the vapours carried, and either completely or partially rectify the constituents. In many plants, in order to reduce the first cost, the various light oils are washed from the gas and are then distilled into a water-white crude state, leaving the production of the chemically pure benzene and toluene to the manufacturing chemists and the munitions makers; and tars, gas-drips, hydrocarbon oils, &c., are being closely examined to see if they contain paying quantities of benzene and toluene.

In plants where the crude product only is produced, it is desirable, owing to the wide range in values of the constituent oils, that the producer and purchaser have an accurate and simple method for analyzing them. Upon consulting literature covering such tests, the authors found that nothing acceptable is given. The reason for this is that under ordinary circumstances prices were low, and there was no great difference in the returns for the various oils. Information from present large producers and purchasers of the oils also reveals the fact that a simple and accurate method either has not been developed or is kept secret.

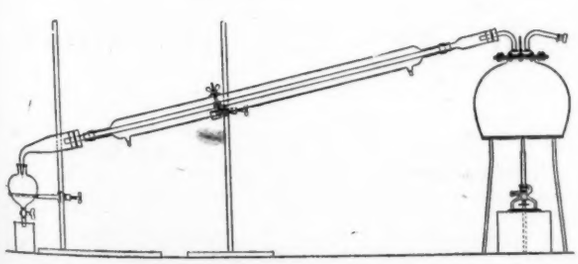
The great importance of such a method (more especially to the producer) is well illustrated by the following instance: Three chemists connected with different large concerns made analyses of some crude toluol—two of them reported 20 per cent. available toluene; the third reported about 40 per cent. available. Later a refining plant actually recovered 40 per cent. of toluene. Had the producer sold on a 20 per cent. analysis, he would have lost a considerable amount of money.



A. One-Third Inch Thermometer. B. Connecting Tube. C. Condenser Tube, 21-inch by ½-inch inside diameter. D. Dephlegmator Thermometer. E. Dephlegmator Jacket, 14-inch by 1-inch diameter. F. Inner Concentric Tube, 16-inch by ⅜-inch outside diameter. G. Hempel Column, 40-inch by 1-inch inside diameter. H. Copper Flask, 5½ inches diameter.

Fractional Distillation Apparatus for Benzene, Toluene, and Solvent Naphtha.

Calcium Chloride Dryer.



Steam Distilling Apparatus.

While developing the apparatus described below, the authors tried a number of distillation columns with the object of finding one which would give a large percentage of benzene and toluene in the pure state. After weeks of testing, they found that an efficient dephlegmator (reflux condenser) was a vital necessity, and that such a dephlegmator was easily made by simply choking the tube of a Liebig condenser with a sealed tube slightly smaller than the inside diameter of the condenser tube. The dephlegmator was tried first with a Hempel column containing small pieces of ⅛-inch glass rod, small pebbles, and beads, as they did not have very many beads on hand. This column gave intermediates over 50 c.c. in volume. They then procured ¼-inch spherical glass beads and tried them, with the result that the intermediates were reduced more than 50 per cent. in volume.

We believe that the apparatus described cannot be excelled for efficient fractionation of benzene and toluene, and so offer it to the gas fraternity with the hope that it will prove especially valuable to those who produce light oils or distillates for sale in the crude state.

Value of Apparatus Developed.

The great value of the apparatus to be described is evident from the following facts:

(1) The benzene and toluene produced will distil within 1·5° C. when tested in a side-neck distillation flask.

(2) The intermediates will average 25 c.c., and should not exceed 40 c.c. [We have obtained from 17 to 35 c.c.]

(3) One fractional distillation will give the percentage of benzene, toluene, and solvent naphtha within a few tenths of 1 per cent.

(4) If the distillation is carried straight through at a rate not exceeding one drop a second, the benzene and toluene produced will distil 97 per cent. within one degree—the intermediates remaining the same as above.

(5) 500 c.c. of pure benzene and 400 c.c. of pure toluene were mixed with some solvent naphtha free from both. A fractional distillation of this mixture yielded the following results:

Up to 81°	480 c.c.
109°	27 ,,
111·5°	375 ,,
137°	21 ,,

A distillation of the first intermediate indicated a mixture between 65 and 35 and 70 and 30. Taking the former, we get 18 c.c. of benzene and 9 c.c. of toluene. The distillation of the second intermediate also indicated a mixture between 65 and 35 and 70 and 30. The former gives us 14 c.c. of toluene and 7 c.c. of xylene. Summing up, we have—

Benzene	498 c.c.
Toluene	398 ,,

Taking the latter figures for the intermediates, the benzene will increase 1 c.c. and the toluene will remain the same.

Details of Apparatus.

A 2200 c.c. copper flask is fitted with a 40-inch Hempel column having an inside diameter of 1 inch and filled with ¾-inch glass balls for 36 inches of its length. [We use 1-inch combustion tubing.] Attached vertically to the top of the Hempel column, is a 21-inch Liebig condenser tube (enlarged end up) with an inside diameter of ½-inch. The condenser tube has an open-top Liebig condenser jacket, 14 inches long, and is fitted inside with a sealed tube, ⅜ inch by 16 inches outside, set concentrically by means of vertical wires or by protuberances on the tube itself. The top of the condenser tube is fitted with a side-neck connecting tube, the delivery tube of which is bent down, and connected to a Liebig condenser with a 30-inch jacket set almost vertical. An extra long condenser tube with an adapter on its lower end, is used. This brings the distillate down to a convenient place for changing the receivers.

All temperatures taken of the vapours are measured with a certified gas-filled Centigrade thermometer, which has been scaled for 3-inch immersion, and has a range of 75° to 150° in one-fifth degrees. The graduations start about an inch from the immersion line (so as not to be covered by the cork) and run about forty to the inch. All thermometers used for any of the distillations are set with the immersion line at the bottom of the cork and the top of the bulb not higher than the bottom of the side-neck opening. All measurements of volume are made in stoppered cylinders, and at a temperature of 20° C.

A Jena side-neck flask is used for distilling off the desired portion of the naphtha remaining in the copper flask at the end of the distillation. A 12-inch Liebig condenser, and a 3-inch immersion certified thermometer graduated in single degrees, can be used.

A one-gallon copper still, fitted for live steam distillation, is used for further purification of the oil after the treatment with acid and alkali. This is connected to a Liebig condenser having a 30-inch jacket and an adapter on the lower end of the condensing tube.

For drying the oil after the steam distillation, a 1-inch by 30-inch tube is set vertically—glass wool being placed in the bottom, and the tube filled with fresh granular calcium chloride.

The intermediates and known mixtures are tested in a 50 c.c. Jena side-neck flask connected to a Liebig condenser having a 12-inch jacket, and set at angle of about 30° from the horizontal. The condenser tube has an adapter on its lower end, and the

temperatures are taken with the one-fifth degree thermometer. The cylinder used for measuring is graduated in 0·2 c.c.

Purification of the oil is made in a 2500 c.c. separatory funnel, or a half-gallon aspirator bottle with a glass stop-cock inserted in the upper stopper can be used.

In order to prevent excessive distillation losses, the following precautions should be taken: (1) While making tests, all condensers and receivers in use should be cooled to at least 15° C. (2) Extra select corks should be used for connections. (3) While the distillate is being collected, a damp cloth should be wrapped around the adaptor and the receiver opening, to prevent circulation of air.

Preparation of Sample for Distillation.

A sample of 2100 c.c. of the crude oil is placed in a 2500 c.c. separatory funnel, and 100 c.c. of sulphuric acid (sp. gr. 1·84) is added slowly. If much heating takes place, the acid is added a little at a time and thoroughly shaken with the oil for about a minute after each addition. The mixture should not be cooled unless the container becomes uncomfortably warm; and then it should be cooled only to be about 50° C., as a warm temperature is especially conducive to good quick separations when working with oils that heat very much. Such oils also will create considerable pressure in the vessel. This should be relieved every few seconds by inverting the container and opening the stop-cock.

After all the acid has been added, the mixture is agitated thoroughly for five minutes and then allowed to stand for fifteen minutes, in order that the acid tar may settle out. At the end of this time, the sludge is drawn off carefully into a beaker of water. If it partially dissolves in the water, forming a muddy solution, then enough acid has been added to destroy the olefines; but if it sinks to the bottom without mixing, then a second 100 c.c. of acid should be added, and the procedure repeated. The acid treatment should be repeated until the sludge partially dissolves in the water. Any oil that follows the sludge can be blown off into a small separatory funnel, the water drawn off, and the oil returned to the main sample. After the final acid treatment, a little water is poured down the side of the container, allowed to settle, and drawn off. This will remove the little sludge remaining in the bottom.

A 200 c.c. warm sodium hydroxide solution (1 to 10) is now to be added, and the mixture thoroughly agitated for five minutes. If this fails to change the oil to a lighter colour, then a little more of the hydroxide should be added. The mixture is then allowed to settle, until there is a clean-cut separation between the oil and the hydroxide, after which the hydroxide is carefully drawn off.

The washed oil is now placed in the steam still, heated to boiling with a small burner, and a slow current of steam then turned in. [A half-gallon still will furnish enough steam for the distillation. It should have a large riser, so as to allow any condensation to drain back.] The distillation is continued until the flow of oil practically ceases. The temperature of the vapours leaving the still will gradually rise to 100° C. before the distillation is finished. If a small flame is kept under the steam-still during the distillation, it will prevent the condensation of much steam in the still, and increase the rate of distillation. The distillate is collected in the same vessel as was used for the acid treatment, and the water drawn off when necessary. When the distillation is finished, the remaining water is carefully drawn off, and the oil measured at the original temperatures. The oil now is dried by passing it through the calcium chloride dryer and 20 to 21 times its volume (measured at the same temperature) is placed in the copper flask.

Fractional Distillation.

If the apparatus is new, it will be best to boil some solvent naphtha in the copper flask until the whole column is filled with vapours. The flask is then cooled with water and the column allowed to drain for fifteen minutes. This will practically eliminate the error that would otherwise be due to oil remaining in the column.

The copper flask is connected tightly to the column; the dephlegmator jacket filled with water; and the flask slowly heated. After the oil starts to boil, the condensation in the column will be rapid, and it may fill up with liquid. If so, the burner should be withdrawn just long enough to allow the column to drain. As soon as the distillate begins to come over, the rate is regulated to one drop a second.

The first runnings are taken off up to 79° (corrected). As benzene will sometimes come over below this temperature—a small amount of water in the oil will cause this—it is best to test this fraction for paraffins. The amount absorbed can then be added to the benzene percentage.

The rate now is increased to 5 c.c. a minute. The temperature will soon become stationary (80° to 80·5°), and remain so until most of the benzene is over. As soon as the temperature begins to rise again, the rate is decreased to one drop a second until 81° (corrected) is reached, when the benzene fraction is taken off. Up to this point, the water leaving the dephlegmator should be kept at a temperature well below 80° C., but high enough to allow the distillation to take place at the stated rate.

The next fraction, which we will call the "B-T" intermediate, is distilled at the rate of one drop a second. The dephlegmator water supply is shut off, and as soon as the water boils it is quickly drawn off and replaced with a hot solution of calcium chloride having a boiling point of 105° C. This fraction is then taken off when the temperature reaches 109° (corrected).

Toluene now comes over, and while it is being collected, the rate is increased to 5 c.c. a minute, after having wrapped the Hempel column in asbestos paper. The temperature will soon become constant, around 110·5° and 111°. When it starts to rise again, the rate is decreased to one drop a second, and the fraction is taken off when the temperature reaches 111·5° (corrected).

The calcium chloride solution is now removed from the dephlegmator; the remainder of the column wrapped in asbestos paper; and the distillation continued at the rate of one drop a second until 137° (corrected) is reached, when the distillation is stopped. The condenser is allowed to drain, and the "T-S" intermediate is then taken off.

The asbestos wrappings are now removed; the copper flask cooled with water; and the column allowed to drain for fifteen minutes. The naphtha remaining in the flask may be measured or distilled off to any desired temperature in the Jena side-neck flask. The distillation loss should not exceed 1 or 2 per cent.; and this can be proportionately added to the various constituents, if the percentage content of the oil is wanted.

The intermediates can be taken at the average figures of two-thirds of benzene to one-third of toluene and two-thirds of toluene to one-third of xylene, or their composition determined as described below, and the amounts of benzene, toluene, and solvent found added to their respective fractions.

To test the intermediates, 20 c.c. are distilled in the 50 c.c. side-neck flask at the rate of one drop a second. The temperature (corrected) is noted when the first drop falls into the measuring cylinder, and also the percentage off at the even degrees (corrected), *i.e.*, 86, 88, 90, &c., and 114, 116, 118, &c. Known mixtures also are distilled in the same way, and a permanent table prepared. The composition of the intermediates can then be determined very closely indeed by comparison. The following benzene-toluene and toluene-xylene mixtures will cover most intermediates: 60/40, 65/35, 70/30, 75/25.

The oils for preparing these mixtures can be obtained by distilling some of the pure oils in the fractionation apparatus. The benzene and toluene should be taken off while the temperature remains constant, and the xylene between 137° and 140°. In case the intermediate is less than 20 c.c., toluene (prepared as above) is added to make 20 c.c., and due allowance made for it. The 50 c.c. flask should be supported by a 6-inch square of asbestos board about ⅛-inch thick and having a circular hole in the centre 1 inch in diameter.

Notes.

If so desired, the steam distillation can be omitted. In this case, the oil should be measured after the washing with sodium hydroxide. The naphtha residue from the fractional distillation is distilled to the desired temperature, and the oil remaining in the flask measured.

A low rate of distillation is desirable, as the temperature rises to 81° and 111·5°. This helps to produce small intermediates.

In order to correct for the effect of barometric pressure, the following fractional degrees should be added or subtracted for each mm. of pressure above or below 760 mm. respectively:

81 degrees	·043
109 and 111·5 degrees	·047
137 degrees	·052
Benzene-toluene intermediate	·045
Toluene-xylene intermediate	·050

By starting with less than 2200 c.c. and using a smaller copper flask, the time of distillation can be cut proportionately. In any case, the fractionating efficiency will remain the same. However, unless the oil contains at least 8 per cent. of solvent naphtha, it is best to start with more than 1000 c.c. of the crude oil, as about 70 c.c. of naphtha are needed to send the "T-S" intermediate over.

Sample Distillation.

	Per Cent.	
Oil after steam distillation	93·3	
Up to 79°	0·2	
(due to water)		
81°	44·7	
109°	2·4	85-15
(exceptional)		
111·5°	37·1	
137°	2·0	65-35
Residue (solvent naphtha)	6·5	
Distillation loss	0·4	

Summing-up, and eliminating the loss, we have:

	Per Cent.		
Benzene	0·2		
	44·7		
	2·0		
	0·2	(loss)	
	47·1		47·1 per cent.
Toluene	0·4		
	37·1		
	1·3		
	0·2	(loss)	
	39·0		39·0 ,,
Solvent naphtha	0·7		
	6·5		
	7·2		7·2 ,,
Olefines, &c.			6·7 ,,
			100·0

Paraffins.

As the specific gravity of benzene at 15° C. is very close to ·88, and that of toluene and solvent naphtha close to ·87, specific gravities lower than these figures would indicate paraffins. These can be tested for as follows: 10 c.c. of oil to be tested are carefully measured into a 110 c.c. flask (with 10 c.c. in tenths on the neck) and 25 c.c. of a mixture containing two parts by weight of sulphuric acid (sp. gr. 1·84), with one part of fuming sulphuric acid (20 per cent.), are added. The mixture is then agitated thoroughly for several minutes and allowed to stand for half-an-hour. The volume is then made up to nearly 110 c.c. by pouring concentrated sulphuric acid down the side of the flask. After allowing to stand for an hour, the paraffins can be read off.

Remarks.

Under "Preparation of Sample for Distillation," we have tried to give a general method of treatment for all oils. From the standpoint of final percentages, this method of procedure is as good as any; but a change in details may save time in some instances without affecting the final results. A little experimenting will indicate any advisable changes, such as (*a*) washing with warm water, before using the sodium hydroxide solution; (*b*) using a weaker solution of sodium hydroxide; (*c*) treating with several small portions of sulphuric acid, instead of one large one; (*d*) distilling dry, instead of with steam, &c.

MANUFACTURE OF SULPHURIC ACID.

Some time ago—to be precise, in the "Journal" for Nov. 17, 1914, p. 345—the suggestion was made that gas undertakings should, where of sufficient magnitude, or in combination in the case of smaller concerns, produce sulphuric acid from their own spent oxide. In view of this, and also because of the probable extended demand that will be experienced by sulphuric acid makers through the industrial developments that are taking place consequent upon the war with Germany, it is possible that the manufacture of sulphuric acid will be taken up to a greater degree by carbonizers of coal who purify their gas by oxide of iron. This being so, it may be of interest to put on record one section of an extensive paper read by Mr. Christopher Barber, F.C.S., at a recent meeting of the Sheffield University Gas and Coke-Oven Students' Association. In it, the author describes at some length what may be taken as ordinary practice; and in order to bring the matter within the space available, it has been necessary to eliminate some of the details as to the plant—leaving in references to methods, and any comments made by the author thereon. Earlier sections of the paper dealt with the Koppers coke-ovens and system of direct recovery of ammonia in the form of sulphate, the recovery of benzol and toluol, and coal-tar distillation.

Coming to the part which is reproduced here, on the "Chamber Process of Sulphuric Acid Manufacture," Mr. Barber said that, although sulphuric acid is absolutely the base of all chemical industry, very little progress has been made in the mode of manufacture this last twenty years. The manufacture of sulphuric acid is in reality a very large industry. Quite apart from the alkali industry (and at the present time the extraordinary demands for explosive manufacture), enormous quantities of it are required for the manufacture of artificial manures, coal-tar dye manufacture, petroleum refining, and in the heavy woollen district for the extraction of grease from mill refuse. Coke-oven people and gas engineers have begun to realize the advantages and benefits to be gained by erecting plant for manufacturing sulphuric acid for their own consumption, and, moreover, to supply their sulphur requirements to a great extent, if not entirely, by recovering the sulphur from coke-oven gas by means of oxide of iron.

An outline of the process of vitriol making as usually carried out will render clear the details of manufacture subsequently described. Sulphur is one of the forms usually met with in practice—*i.e.*, pyrites or spent oxide is burnt in a kiln or furnace by the heat of its own combustion, in an excess of air to sulphur dioxide. The sulphur dioxide generated is made to unite with an excess of oxygen by the intervention of the oxides of nitrogen. These gases come in contact with moisture in the form of steam, water spray, or weak acid spray in the leaden chamber. A reaction takes place producing dilute sulphuric acid, in which all the constituents except the nitrogen are concerned.

Nitrogen peroxide (NO_2), by the loss of one atom of oxygen, is reduced to nitric oxide (NO), which, in turn, unites with atmospheric oxygen, and is reconverted into nitrogen peroxide. Thus, when sulphur dioxide and oxygen are mixed with nitrogen peroxide in presence of water, a series of reactions take place, the result of which is the above-mentioned dilute sulphuric acid:

$$SO_2 + O + H_2O = H_2SO_4.$$

The nitrogen peroxide may be said to act as a catalytic agent, and is able to react in the same series of changes over and over again; its action theoretically being unlimited. The series of reactions which take place may be represented by the following formulæ:

$$S + O_2 = SO_2$$
$$3SO_2 + 2HNO_3 + 2H_2O = 3H_2SO_4\ 2NO$$
$$2NO + O_2 = 2NO_2$$
$$2NO_2 + 2SO_2 + 2H_2O = 2H_2SO_4 + 2NO$$

A sulphuric acid plant consists broadly of four parts: (1) Furnaces for producing SO_2, combined with dust chamber and nitre oven. (2) Glover tower for cooling the furnace gases, concentrating the chamber acid, and denitrating the nitrous vitriol. (3) Leaden chambers in which the reactions occur. (4) Gay-Lussac towers for the absorption of the oxides of nitrogen.

Mechanical Roasting Furnaces.

Sulphur dioxide is generated by roasting lump pyrites, fines, or spent oxide. The fine pyrites should not be more than ½-inch in size, nor yet too small, as a large quantity of dust would have to be dealt with in the latter case. Spent oxide is, of course, generally in a fine state as purchased; but if lumpy, it should be crushed to pass through a ½-inch mesh riddle. The essential features of a sulphur dioxide furnace are: (1) That it should be capable of supplying a constant quantity of gas of constant quality. (2) It should create as little dust as possible from the burning ore. (3) It must burn the sulphur out of the ore as completely as possible. (4) Every facility must be provided for the proper admission and regulation of air, so as to avoid volatilization of the sulphur and maintain a constant maximum temperature at the inlet to the Glover tower. (5) All wearing parts must be of easy access. The furnace should require a minimum amount of supervision, and be as near fire-proof as possible; and all parts should be of the best material and workmanship.

There are various types of mechanical furnaces on the market for roasting pyrites, fines, and spent oxide—such as the "Herreshoff," "Harris," and "Wedge," and hand-fed furnaces for lump pyrites and spent oxide. Particulars may be given of one or two which are furnishing good results in this country. The burning of lump pyrites is usually carried out in the type of kiln illustrated in fig. 1. Two kilns A are shown in the sketch, one in front elevation and the other in sectional elevation; while B is a cross section showing two rows back to back. The charging opening *a* has a door *b* sliding in a grooved ledge. The slide *c* is for the grate-bars, and *d* for the ash-pit; while the rarely-used door *e* leads into the main gas-flue. The gas-flue is always at the top; each burner-arch having an opening leading into it. The flue itself is formed by springing a double arch about a foot above the burner roof, reaching across the whole burner, and supported by the front plate.

The chief feature of this lump pyrites burner is the employment of grate-bars of square section, movable in bearings. The sketch shows such grate-bars, also the parts which are forged or cast with a circular section, so that they can easily turn in the respective hollows of the bearers. The front piece of each bar, where it projects beyond the bearing-bar, has a square section, so that it can be turned round its axis by means of a suitable key. The spaces between the grate-bars are generally arranged so that with 2-inch bars they are generally about 2 inches apart when the bars are in the square position; but if they are turned 45°, the intervals

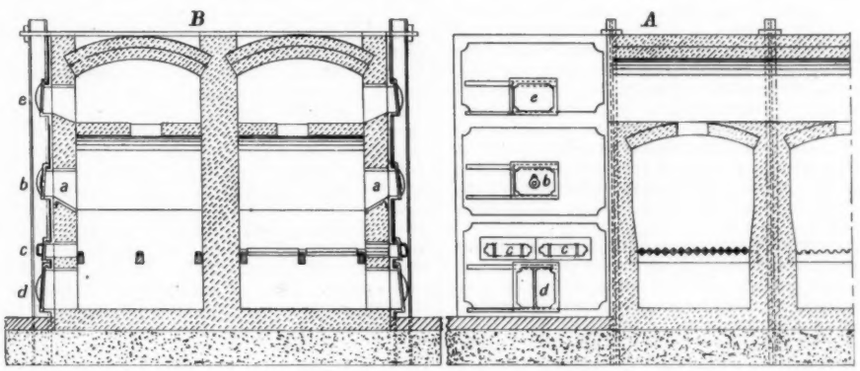


FIG. 1.—LUMP PYRITES BURNERS.

will only amount to 1½ inches. These bars generally stand in the latter position—that is, all with their diagonals in a horizontal plane, or with the smallest intervals, so that pieces of ore cannot drop through. When it is time for a portion of the ore to be removed, the attendant takes hold of the fore end of the bar with his key, and moves it from side to side, so as to exercise a kind of crushing action on the cinders getting between the bars. The spaces are then enlarged, and the cinders jammed between the bars are forced downwards. The workman proceeds from one bar to the other, shakes them according to his own judgment, and in this way takes out an equal quantity of burnt ore over the entire area of the grate.

The mechanical furnace of the Harris type is adapted for roasting either pyrites fines or spent oxide. Each furnace consists of four superimposed brickwork hearths, on which the pyrites or spent oxide is roasted. Through the hearths are fixed two vertical rotating cast-iron shafts, to which the horizontal arms are attached. Two water-cooled arms operate on each hearth; one arm being attached to each shaft. On these arms are fixed rakes or rabbles. By means of these rabbles, the ore is stirred, and fresh surfaces are constantly exposed to oxidation. The material at the same time is guided downwards through the furnace in a radial direction from the centre to the periphery of the arm-path, and *vice versâ*, from bed to bed; the spent ore being removed through a closed shoot at the bottom. The discharge is so arranged as to allow the ore to escape, but prevent the ingress of air. The air necessary for the roasting process enters the furnace opposite each hearth through adjustable slides. This arrangement enables the admission of air to be regulated with precision according to the requirements of the furnace. These openings also serve the purpose of examination of the burning ore, and as manholes when any repairs are required to be carried out.

The various types of mechanical furnaces somewhat resemble each other in general design; the difference between the Harris furnace and other designs being the large beds with two shafts passing through them. Thus claim is made that less dust is created by passing the gas from each bed into the main flue, and by the ore not being dropped so frequently. The stirring mechanism forms the most important feature of a mechanical ore roasting furnace. Some of the original forms of roasting furnaces which were put upon the market had to be abandoned on account of the failure of this part of the furnace; the advantages of the system being more than outweighed by the numerous stoppages and expenses caused by the frequent breakages and other defects of the stirring mechanism.

The two main objects to be attained in the control of the furnaces are: The conversion of as much of the sulphur as possible into sulphur dioxide, and the avoidance of the formation of slag (scars), due to the irregular admission of air, which allows of the production of the fusible sulphide FeS. It is not practicable to expel all of the sulphur from pyrites or spent oxide; the burnt residuum generally containing about 2 per cent. in the form of basic ferrous sulphite, and sulphates of copper and zinc. The burners of a sulphuric acid plant are without doubt one of the most important pieces of apparatus on the plant. A regular supply of gas of constant composition must be generated, as without this it is impossible to work any plant economically. Hand-fed burners are generally built underneath the acid chambers. If placed outside, they must in any case be protected against wind and rain, since this would interfere with the control of the draught and cause irregular working. The object of introducing the mechanical furnace was to obtain a regular supply of gas of constant composition. In this respect it has been successful to a certain extent, for its installation has been so general that pyrites fines are now much more expensive than lump pyrites, whereas a few years ago it was the reverse.

As the gas ascends the furnace, it becomes charged with dust given off by the ore during the time it is being stirred, and more particularly in the channels where the ore falls from one hearth to the other. This dust, which is characteristic of all mechanical ore-roasting furnaces, has to be extracted as far as possible before entering the Glover tower. The general principle which is adopted is to get the flue dust to deposit by cooling, by retarding the velocity of the gaseous current, and by offering to it large surfaces to which it can attach itself. From the furnaces, the polluted gases are passed through a dust-chamber, in order to fulfil the above conditions. At the outlet of the dust-chamber is fixed the potting-oven.

From the formulæ representing the reactions, it would appear as though, once sufficient nitre was added to the plant, further quantities would not be required. [The question of loss of nitre in the chamber process has received no small amount of attention and discussion during the last few years.] However, for various reasons—such as defective absorption, reduction to nitrous oxide, &c.—it is necessary to constantly replenish the supply of nitrogen peroxide. Some manufacturers employ nitric acid as such, feeding it along with the nitrous vitriol down the Glover tower. In nearly every case, however, the nitric acid is introduced in the form of a vapour, and is generated on the plant in the usual way by the action of sulphuric acid on sodium nitrate. This is carried out in cast-iron pots in an enlarged part of the main flue known as the "nitre oven;" suitable supports being fixed inside the oven for carrying the pots.

A large shallow cast-iron dish is permanently fixed on the floor of the oven, so as to catch any nitre cake boiling over the sides of the pots. A small hopper or funnel is fixed in the crown of the oven, through which the nitre is charged in small quantities at a time. The sulphuric acid necessary to decompose the nitrate and liberate nitric acid is introduced through S-shaped syphon tubes, which at the same time serve as traps. The pots are fitted with tail-pipes running through the walls of the flue, so as to draw off the nitre cake (acid sodium sulphate) into suitable moulds when the reaction is complete:

$$NaNO_3 + H_2SO_4 = HNO_3 + Na\,HSO_4.$$

The Glover Tower.

For mechanically producing the draught necessary for the furnaces, a fan, driven by means of a small motor, is installed immediately before the Glover tower. In this way, the draught on the furnaces is rendered independent of the pressure in the chambers. Such fans are, of course, specially constructed, as there is the heat, as well as acids, to contend with. The gases then enter the Glover tower, *viâ* a special pipe. The tower is erected on a platform or pedestal, at such a height from the ground level that the acid can flow by gravity from the dish of the tower through the cooling apparatus and into the storage and working cisterns, and so avoid unnecessary pumping.

The chief functions of a Glover tower are: (1) Denitration of the nitrous vitriol. (2) Cooling of the furnace gases. (3) Concentration of the chamber acid. The first function, which is the most important and characteristic of all, is carried out by exposing the descending nitrous vitriol, mixed with chamber acid, to intimate contact with the ascending hot furnace gas, the heat of which acts with a concentrating effect upon the sulphuric acid, and the sulphur dioxide acts denitratingly on the nitro-sulphuric acid. The simultaneous concentration and action of SO_2 tends to advance the denitration according to the following equation:

$$2SO_2\,(OH)\,(ONO) + SO_2 + 2H_2O = 3H_2\,SO_4 + 2NO.$$

The top of the Glover tower is designed to give a uniform distribution of the acid, and expose it in as fine a state as possible to the ascending gases. The acid fed to the tower comprises all that used for the recovery of the oxides of nitrogen and a large quantity of chamber acid; the strength of the mixture on entering the tower not exceeding 130° Twaddel, so as to ensure perfect denitration. It will be gathered from these remarks that the acid feeding the Glover tower should be carefully regulated; for not only is the chief quantity of nitre supplied here, but also, by the concentration of the chamber acid, a large quantity of steam is generated for the chambers—the whole of the chamber reactions depending upon the successful working of the Glover tower. The hot acid overflows from a lip on the dish of the tower into a leaden cooler; the temperature being reduced by means of circulating water through leaden coils standing in the acid, and through a jacket fixed around the tank.

The Chambers.

The cooled furnace gases leaving the tower enter the chambers, erected on cast-iron pillars at a considerable height above the ground level; the space below being used for storage tanks, acid elevators, &c. If hand-fed kilns are employed, these are erected beneath the chambers adjacent to the Glover tower. The chambers themselves are constructed of sheet lead supported by a wooden framework. The uprights comprising the framework are constructed on the diamond principle, so as to keep the lead-work clear of the supports, and thus afford uniform cooling. The reactions taking place inside the chamber are exothermic; and the large number of calories evolved can only be dissipated by direct transmission through the chamber walls. The side sheets are suspended like a curtain in a large flat dish made by turning-up the edges of the bottom sheets. The dish is always kept luted with acid when the chamber is at work; the upstand being reinforced with boarding to resist the pressure of the acid inside.

The chambers, which are much narrower and taller than those usually adopted, are fitted with sprays. The water necessary for the reactions of the process is passed through sponge filters and small strainers, in order to get rid of any suspended foreign matter, and then into the chambers in the form of a mist or fine spray. This method of spraying water in place of employing steam increases the productive capacity of the chambers, and facilitates regular working. On the sides of the chambers are fitted drips, at the side of which a thermometer is fixed reaching several inches into the chamber; and by means of these the strength of the acid formed and temperature inside the chambers are recorded. The drip is a small dish or saucer inside the chamber, and communicating with the outside by a pipe bent to make a seal. The acid as formed collects in the saucer, and drains through the seal into a small jar provided with a hydrometer. The strength of the acid collected in the drip, and the temperature, are periodically recorded; and any variation in these indicates irregular working. By carefully comparing the various results on the plant, the cause of the irregularity may usually be located.

The strength of the drips and temperature for normal working vary on nearly every plant. In this country, the acid in the first chamber is generally kept at from 120° to 125° Twaddel, and the admission of water regulated according to the strength of the drips, which are, of course, usually from 6° to 10° Twaddel higher than the bottom acid. If the strength exceeds 125° Twaddel, the quantity of nitrous fumes dissolved in the acid begins to increase considerably, and the acid starts to act deleteriously upon the lead. On the Continent, the general method is to keep the first chamber

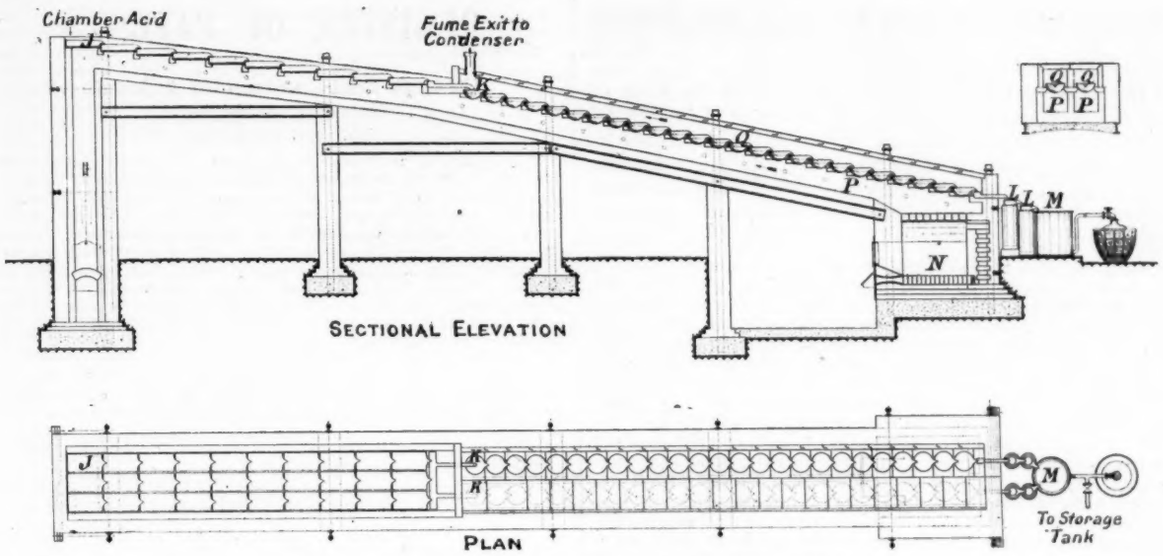


FIG. 2.—SULPHURIC ACID CONCENTRATION PLANT.

from 106° to 110° Twaddel; and the subsequent chambers are all worked slightly weaker than the first—the last chamber being usually kept at 90° to 100° Twaddel.

For continuously observing the colour of the gases in the chambers, glass windows are fixed at a convenient height in the side sheets of the chambers and in the exit-pipe from the last chamber; the gas being viewed in the case of the chambers diagonally upwards towards a light in the roof of the chamber consisting of a bell-jar fixed in a hydraulic lute. In the first chamber, no decided colour can be detected, on account of the chamber being full of sulphurous vapour. The following chambers, however, should appear distinctly reddish yellow; the colour gradually deepening, till in the last chamber it is dark red, and even in the exit-pipe to the Gay-Lussac tower it shows a decided colour.

The pressure of the gases in the set of chambers is not uniform throughout; the usual method of working being to have a slight outward pressure in the first chamber. In the intermediate chambers, the gas is practically in equilibrium with the atmosphere; while in the last chamber there is a slight suction. These pressures are regulated by means of dampers, and the position of the fan where mechanical draught is employed. In any case, the draught is so controlled as to give an exit gas containing approximately 6 per cent. of oxygen.

The Gay-Lussac Tower.

For drawing-off the acids from the chambers, and for passing from one chamber to the other, recesses are provided in the sides of the chambers, having pipes and plugs fitted in the dish. In order to recover the oxides of nitrogen issuing from the last chamber, the gases are led into Gay-Lussac towers. These towers, which are indispensable for the rational manufacture of sulphuric acid, act in the same way as an ordinary benzol scrubber, or the tower-scrubber on a gas-works for the extraction of ammonia—*i.e.*, they must present as large a surface as possible, so as to bring the gases ascending the towers into intimate contact with a moderately strong solution of sulphuric acid sprayed at the top and passing down the tower. Not only do the towers carry out the above functions—at the same time preventing the escape of acid fumes into the atmosphere—but they save a large proportion of the chamber space, or, in other words, determine the intensity at which a plant can be worked.

For the Gay-Lussac towers, the author thinks the best packing medium to be employed is good hard-burnt furnace coke, of proper size and carefully packed. It should be clearly understood, however, that after lengthy working the coke is apt to disintegrate, in which case it has to be taken out and the tower repacked. For the complete absorption of the oxides of nitrogen, the cooled acid from the Glover tower, 148° Twaddel (80 per cent.), is delivered to the top of the Gay-Lussac tower into an overhead tank.

Pipes lead the acid from a box to the lutes of the No. 2 Lussac tower. This box is divided by radial partitions into sections, which are continuously fed with acid by means of a frictionless wheel or rotating distributor working on the tangential principle of a Barker mill. This reaction wheel is fed with acid from the overhead tank; the quantity delivered to the tower being regulated by a tap. The acid drawn off from the No. 2 Lussac tower is now fed into No. 1; the method adopted being to bring the fresh acid into contact with somewhat inert gas, and so ensure perfect absorption. The whole of the acid for feeding the various towers is forced into the tanks at the top of the towers from Kestner automatic elevators by means of compressed air. The latter work continuously, and the rate of supply can be regulated from below.

Between the Gay-Lussac towers is placed a second fan, for producing a suction on the chambers, exhausting the gases from the first tower, and delivering them into the No. 2 Lussac tower; the outlet of the second tower leading into the atmosphere.

Concentration of Sulphuric Acid.

Sulphuric acid, as produced in the chambers, at a strength of 106° to 124° Twaddel is not sufficiently concentrated for the manufacture of sulphate of ammonia or for general purposes. With the Glover tower, however, it is possible to concentrate the acid to 142° or 148° Twaddel, and so be of suitable strength for direct use in the saturator. If, however, a purer acid is required, or where it is desired to produce a highly concentrated acid of 168° Twaddel (95 to 98 per cent.) for benzol washing, aniline manufacture, or other like processes, the chamber acid has to undergo a process of evaporation.

Fig. 2 shows a sectional elevation and plan of a cascade concentrating plant, the essential features of which are the trays and basins. These are made of fused silica; this material being adopted on account of its acid-resisting properties, and (by reason of its low coefficient of expansion) of being able to withstand great ranges of temperature. The heating arrangements are those usually met with; the furnace being arranged for using low-grade fuel, such as coke breeze, or, with slight alterations, for burning coke-oven gas.

The chamber acid to be concentrated enters the shallow vitreosil trays J at the top of the cascade seated over the flue; this arrangement of trays economically allowing the acid to be gradually heated-up to the necessary temperature before the actual concentration commences. The acid finds its way by gravitation to the silica basins K, and, flowing through each successive basin, leaves the cascade and enters the pot-type coolers L, finally overflowing to the leaden cooler M, where the temperature of the acid is reduced to that of the atmosphere. The hot gases from the furnace N are drawn along the flue P, and come in direct contact with the bottom of the basins and trays, excepting those situated over the furnace—finally finding their way to the chimney. The acid fumes which are driven off in evaporation ascend the enclosed flue Q, and are passed to a coke-scrubber.

A Plea for Sulphuric Acid Manufacture.

For some time past there has been considerable difficulty in obtaining supplies of sulphuric acid for sulphate manufacture, both on coke-ovens and gas-works. Even before the outbreak of war, numerous plants were working from hand to mouth, and were being put to considerable trouble and inconvenience by this method of delivery, as well as the quality of the acid supplied. The only way out of the difficulty is for coke-oven proprietors and gas undertakings to erect sulphuric acid plant on the site. Why should we not recover the sulphur from coke-oven gas by means of oxide of iron in a similar manner to that already carried out on gas-works? No one is in a more favourable position for manufacturing sulphuric acid than the gas engineer or coke-oven manager. A good many coking-plants and gas-works are perfectly qualified to enter into the field for its production at the present time. On the other hand, some works, although not individually large enough for manufacturing sulphuric acid, and where situated in the same district, can take up the manufacture by the formation of an independent company capitalized by the private money of the smaller concerns—which company could trade and compete with the present makers of sulphuric acid.

North of England Gas Managers' Association.—The annual meeting of the Association will be held at the Gas Office, Newcastle-upon-Tyne, next Saturday—Mr. Thomas Waddom, the President, in the chair. In addition to the formal business, two papers will be submitted—one by Mr. Geoffrey Weyman, M.Sc., entitled the "Effect of War on Gas-Works Practice," and the other by Mr. Herbert Lees (the Hon. Secretary), on the "Special Purposes Section." Tea will be served after the meeting.

DEVELOPMENT OF THE ST. GALL GAS-WORKS.

By M. ZOLLIKOFER.

The following is a summary of novel points in the paper on the "Development of the Gas Supply of St. Gall" (Switzerland) which M. Zollikofer, the Manager, read at the last annual meeting of the Swiss Association of Gas and Water Engineers. Descriptions of the St. Gall Gas-Works, which present many features of exceptional interest to gas engineers, have been given from time to time in past volumes of the "JOURNAL"—notably in Vol. XCI., p. 378, and Vol. XCIX., pp. 227 and 826.

The St. Gall Gas-Works were constructed in 1857, and until 1865 produced only wood gas; from that year to 1899 only coal gas; and since the latter year both coal gas and carburetted water gas. In 1887, when the gas-works passed from a private Company to the Corporation, the gas produced amounted to 41,723,000 cubic feet. Gradual extensions of the district of supply were made, and in 1900 the annual production of gas was 125,178,450 cubic feet. In 1903, the works were transferred from the town to the shore of Lake Constance; the new site being rather more than six miles from the town. A number of small places along the shores of the lake were thereafter supplied with gas from the St. Gall undertaking. The supply was extended to other outlying and elevated districts in 1913, in which year the total production had reached 375,537,653 cubic feet, from which figure there was a slight fall in 1914.

The district supplied presents difficulties in regard to the distributing system which are quite exceptional. In the first place, St. Gall itself lies in a long narrow valley between precipitous mountain slopes; in the second place, the westerly or dead end of the town distributing system is fully 95 feet lower than the gasholder station, which is nearly 830 feet higher than the gas-works at Riet, on Lake Constance; in the third place, the subsoil of the town itself is difficult. Glacier *débris*, peat, dry clay, and sand alternate with layers, 20 feet thick, of pasty sand. The streets, moreover, are narrow and traversed by much traffic.

On the trunk main which brings the gas from the works to the gasholder station at St. Gall are two branches—one leaving it about four miles from the works and having a length of about three miles for the supply of Wittenbach, which stands lower than St. Gall, and the other leaving it about five miles from the works and supplying, by two arms, districts at a considerably greater altitude—the end point of one of the arms being nearly ten miles from the trunk main and, consequently, fifteen miles from the gas-works. The highest point of this arm is 1935 feet above the level of the works. There are also two shorter branches, to outlying places, from the trunk distributing main on the town side of the gasholder station.

A number of pressure recorders have been fixed over the whole distributing system; and the mains have been laid and extended in the light of the information afforded by them. The result is that the use of inverted burners continues to extend throughout the district. Each of the village communities supplied has an automatic pressure regulator or governor, which controls the pressure in the local distributing system. There are pressure recorders on each side of these district governors, under the supervision of a foreman fitter living near by. The pressure recorder on the works' side of the governor registers pressures up to 31½ inches of water, and each record sheet serves for 60 days; but the clockwork has to be wound every 8 to 14 days.

Suggested Sources of Ammonium Sulphate.

A paper on "Kerogen and Kerogen-Shales," read recently before the Institution of Petroleum Technologists by Mr. E. H. Cunningham Craig, concluded with the following statement in regard to suggested fresh sources of ammonium sulphate: Vast masses of highly inspissated oil-sands are known to exist in the Empire, the greatest being the tar-sands of Athabasca, though both Trinidad and Barbados contain very large areas of similar material easily worked from outcrop. The distillation of oil from the deposits has often been suggested; but the cost of the extraction is so great compared with the cost of drilling for petroleum, that the commercial exploitation of the dried-up oil-rocks has not been attempted on a large scale. But if a valuable bye-product in the form of ammonium sulphate could be obtained in sufficient quantity from the deposits, a commercial success would be in sight. It has been shown that nitrogen compounds become concentrated in proportion to the state of inspissation; and we have *primâ facie* evidence that the nitrogen contents of such strata as the Athabasca tar-sands and the La Brea oil-sand of Trinidad cannot be altogether negligible. It was the production of ammonium sulphate that saved the Scottish shale-oil companies from extinction through competition with imported American oil. Similarly a yield of this valuable salt may enable these great deposits of inspissated oil-sand to be quarried or mined and retorted at a profit.

Mr. Henry Lesser, Barrister-at-Law, Secretary of the South Metropolitan Gas Company's Employees' Provident Society, will deliver an address on Friday of this week, at the annual spring meeting of the Textile Institute, Manchester, on "Employers and National Health Insurance."

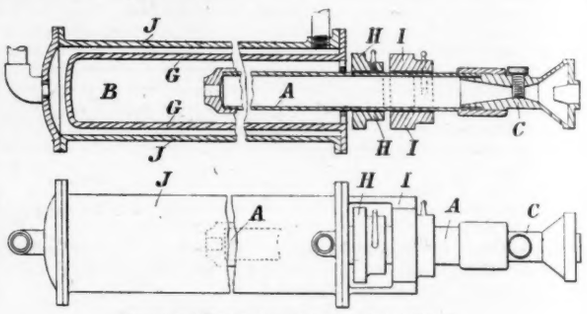
REGISTER OF PATENTS.

Gaseous Fuel Combustion Apparatus.

TURNER, E., of Manchester.

No. 1357; Jan. 27, 1915.

This apparatus comprises an elongated combustion chamber provided with a burner the nozzle end of which projects into the chamber; the substances to be heated being contained in, or passed through, a chamber surrounding the combustion chamber. The apparatus is more particularly intended for use in the heating of tanks of water or other liquid, the maintaining of baths of molten metal above a certain temperature, the superheating of steam, and the heating of gases and vapours—the chief object being to provide a heater wherein the point of combustion may be varied as required, and thus "enable the heat to be developed under readily regulatable conditions and within well-defined zones or regions."



Turner's Adjustable Gaseous Fuel Heater.

A section and plan are given of apparatus applicable to the heating of fluids or liquids.

A is the gas supply tube and B the combustion chamber, which consists of a cylinder G having a dome-shaped end and within which the gas supply tube is arranged axially. It is provided with an injector at C and an adjustable damper H, for controlling the exit openings from the combustion chamber. A bracket or bridle I is also provided on the supply tube to permit of it being adjusted so that the point of combustion may be varied to suit requirements. When in use, the cylinder G is enclosed in the liquid of the fluid container J, which is provided with an inlet and outlet for the substance undergoing treatment.

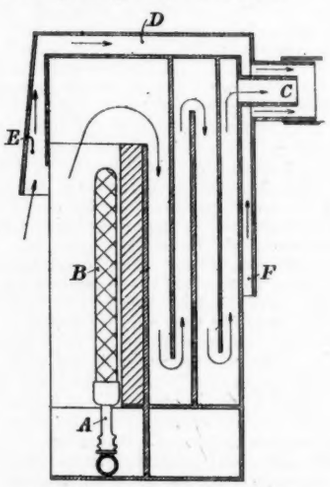
In order to start the heater, the gas is lit at the exit openings, whereupon the flame spontaneously strikes-back into the chamber B or can readily be made to do so by adjusting the damper. The air necessary for supporting combustion may be sucked into the supply tube by the injector C, or, if desired, it may be mixed with the gas by means of a mixing apparatus, compressed gas plant, or air-blast prior to the admission of the fuel to the heater. In the latter case, the injector is omitted.

Gas-Stove.

STOKVIS AND ZONEN, LIMITED, of Rotterdam.

No. 5316; April 8, 1915. Convention date, April 11, 1914.

The object of this invention is "to provide a gas-stove which is to a large extent independent of the draught in the chimney, and from which combustion products can only escape into the room under very bad conditions of the ventilation and of the draught in the chimney." A further object is to provide a stove having these features which is not limited in its use to a special position in the room.



Stokvis and Zonen's Gas-Stove.

This is said to be attained by combining in a stove baffled passages for the combustion products and air passages separated from the combustion chamber and the flue—the passages opening at one end into the room to be heated and at the other end into a common chimney or

into a flue. In order to increase the efficiency of the arrangement, one or more of the air passages may, it is said, be disposed in such a manner relatively to the combustion chamber and the passages for the combustion products, that the air in them is heated by the combustion gases, and a draught is produced so as to draw-in air from the room. The inlet end of the air passages is so placed that any combustion gases which might escape into the room, "through considerable disturbances in the draught of the chimney," are drawn off immediately through the air passages.

The burners A are placed beneath incandescent bodies B, behind which a fire-proof slab is placed. The combustion products pass through the stove in the direction of the arrows, and finally escape through the outlet opening C to the duct leading to the chimney.

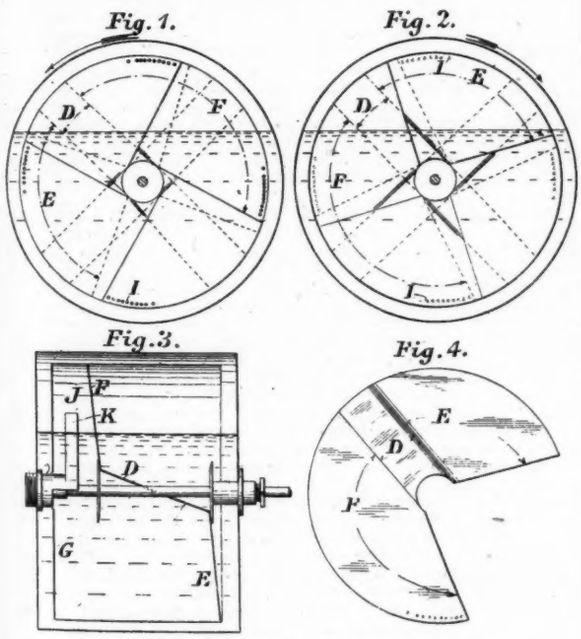
The stove is provided with passages D, E, F, separated from the combustion chamber and from the general flue, which passages at one end open into the room to be heated and at the other end into the common duct. The inlet passage E is disposed in such a manner relatively to the combustion chamber that a draught is produced by the heat generated in the combustion chamber, and the air in the room is thus drawn in and led to the chimney. "By this draught, combustion products which might escape in the direction of the room, owing to a draught arising by the sudden opening of a door, or any other reason, will be carried off by way of the passages D E to the common chimney.

Rotary Air and Gas Compressors.

WILLETT, H. W. M., of Sloane Square, S.W.

No. 10,834; July 26, 1915.

This invention has reference to rotary liquid sealed air and gas compressors comprising a number of compartments arranged around a centre and into each of which, in turn, air or gas is admitted at one part at one pressure—say, ordinary atmospheric pressure—then compressed by the sealing liquid during rotation of the compartment, and afterwards discharged at another part at a higher pressure. The object



Willett's Rotary Gas and Air Compressors.

is to produce apparatus wherein the pressure of the air or gas in the delivery chamber into which the compartments successively deliver their compressed charges shall be maintained as nearly as possible uniform, so as to avoid any pulsating action of the air or gas in the pipe with which the compressor is used.

Rotary compressors of the kind described can be constructed in various forms, one of which is illustrated. Figs. 1 and 2 are sectional elevations of the compressor viewed from opposite sides; fig. 3 is a transverse section more or less diagrammatic; and fig. 4 is a view of a portion of the compressor removed for the sake of clearness.

The construction comprises a drum and casing—the drum arranged horizontally and containing the sealing liquid. It is divided internally into a number of longitudinally extending compartments arranged around an axially disposed driving shaft and constituted in part by a number of flat plates D equally spaced around the driving shaft and inclined to the axis thereof. Each division plate is connected at its ends to two transversely extending end plates E F, slightly inclined at right angles to the axis of the shaft. One, E (the front plate), is arranged at the inlet side of the drum, the other, F (the rear plate), towards the opposite or delivery side of the drum, but at a distance from a centrally perforated rear end wall G of the drum. Each front plate is arranged to overlap the outer side of the plate in advance of it, and form with it an air inlet passage to the compartment between the division plates to which the two front plates are connected. In like manner, the rear plate connected to each division plate extends backwardly and overlaps the outer side of the rearwardly extending rear plate of the next division plate to the rear, and forms with it a delivery passage from the corresponding compartment. The outer peripheral edges of the division plates and front and rear plates are united in a fluid-tight manner to the drum. The inner edge portions of the division plates are of concave semi-elliptical shape, so as to lie upon, and extend partially around, a cylindrical surface inserted between them, and of such a diameter that the division plates will always be effectually sealed by the liquid. This leaves a cylindrical passage through the centre of the drum, and "reduces the liquid friction of the entire drum to a small amount."

There may (as shown) be four compartments formed by and between the division plates and front and rear plates. In this case, the forward edge of each front plate is so arranged that the inlet passage formed by, and between, it and the next forward front plate is just closed when the corresponding compartment is in its uppermost and mid position with the division plates inclined at 45° to the horizontal, in which position the capacity of the compartment above the level of the sealing liquid is at its maximum. Each rear plate extends backwardly to an extent greater than is necessary for compressing the air or gas in the corresponding compartment to the required pressure, and is formed with a number of small apertures I arranged to be uncovered in succession as they rise above the surface of the sealing liquid—for example, one behind the other in a segment of a circle having its centre at the axis of the drum. The apertures are for equalizing the pressure in the compartment to which they belong and that in the delivery chamber into which the preceding compartment is then delivering air under the required pressure.

The space between the rear end wall G of the drum and the perforated rear plates forms the delivery chamber J into the portion of which, above the water level, the compressed air or gas is delivered from the compartments in succession. Through the central hole in the rear end wall and into the delivery chamber J extends a stand-pipe K, to lead away the compressed air or gas.

The action of the compressor is as follows: Assuming the drum to be rotating in a clockwise direction (fig. 2), the air or gas that has entered the uppermost compartment from the portion of the casing above the sealing liquid is trapped in the compartment when the latter reaches its uppermost or mid position. Upon the continued rotation of the drum the volume of the air space in the compartment above the water level gradually becomes less—thereby commencing the compression. After a time the apertures in the rear end plate of the compartment commence to rise one after the other above the surface of the sealing water, and thereby place the compartment in communication with the delivery chamber J. At this time, owing to the overlap in the air outlet passage of one compartment and the next, the previous compartment to the one whose action is being described (the first compartment) is delivering air or gas at an excessive pressure, which tends to raise the pressure in the delivery chamber above the normal. The first function of the holes in the rear plate of the first compartment is to permit the excessive pressure to be reduced by allowing some of the air or gas to pass into the compartment, which it can do as the air or gas in it has not at the time reached the required normal pressure by reason of the reduction of volume of the compartment. As this rotation of the compartment continues, the air or gas is finally discharged into the delivery chamber, first through the last few apertures I of the series and then through the main delivery outlet passage—like the preceding compartment, the delivery being maintained until the whole of the compartment is below the water level. The same action takes place with each compartment in turn.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF COMMONS.

The following further progress has been made with Bills:

Bills, as amended, considered, and to be read the third time
Burnley Corporation Water [Lords], Folkestone Gas.

Production of Benzol.

On Tuesday last week, COMMANDER BELLAIRS asked the President of the Board of Trade whether he had consulted with the Minister of Munitions in regard to the growing shortage of petrol, and the proposal to establish plant at the pit-mouth of each colliery to distil benzol from coal and obtain the important bye-products; and whether he was aware that this is done in Germany in the majority of collieries?

Mr. RUNCIMAN replied that considerable attention had been given, especially during the past year, to the extension of bye-product coking plant in this country, both in connection with gas-works and in coke-works at collieries.

COATBRIDGE GAS PROVISIONAL ORDER.

One of the three Provisional Orders which have been lodged with the Secretary for Scotland is being promoted by the Coatbridge Gas Company; the principal object being to raise additional capital. The Company was incorporated in 1877, with a capital of £44,650; and since then various amounts have been raised and borrowed as authorized. It is explained that the demand for gas for domestic and general purposes within the limits of supply of the Company has very greatly increased, and is still increasing. Gas is being supplied to various works for the manufacture of munitions of war, and demands for such supplies are also increasing. It has become necessary for the Company to provide new and improved retorts, and otherwise to extend their plant, to enable them to meet the demands made on them for gas. They, therefore, ask authority to raise additional capital not exceeding £40,000 by the creation and issue of new ordinary shares or stock or new preference shares or stock. Power is further asked to borrow in respect of the additional capital.

MISCELLANEOUS NEWS.

SPONTANEOUS COMBUSTION OF COAL IN MINES.

Witnesses before the Departmental Committee.

An indication was given in last week's issue [p. 188] of the evidence tendered by certain witnesses who appeared before the Home Office Departmental Committee appointed to inquire into the circumstances in which spontaneous combustion of coal occurs in mines, its causes, and the means of preventing it or of dealing with it when it has arisen. The Chairman was Mr. (now Sir) R. A. S. Redmayne, C.B., the Chief Inspector of Mines; and the other members of the Committee were Sir Arthur B. Markham, Bart., M.P., Mr. C. E. Rhodes, Mr. Frank Rigby, and Mr. Herbert Smith. The evidence of other witnesses—among them Dr. Bone—may now be similarly dealt with.

Professor *William A. Bone*, who explained that he holds the position of Professor of Chemical Technology at the Imperial College of Science and Technology at South Kensington, and previously was the Livesey Professor of Coal Gas and Fuel Industries at Leeds, said he had done a great deal of scientific work in connection with combustion during the last twenty years. He had given much consideration to the question of surface combustion. Asked whether he had formed any ideas, from the scientific point of view, as to the causes which lead, or may lead, to outbreaks of spontaneous combustion in coal mines, he said he had not done any practical experimental work himself on the spontaneous combustion of coal, but he had read in detail the principal experimental researches on the Continent and in America, and also the opinions of one or two leading English authorities—such as Mr. Richard Threlfall. These, together with his knowledge of the action of surfaces in regard to combustion, had enabled him to arrive rather tentatively at certain general views. There were matters with regard to which it seemed to him desirable that further experiments should be made. Richter's conclusion, that the main cause of spontaneous combustion was the absorption of oxygen by the coal substance itself (which began at ordinary temperatures, and was accelerated by a rising temperature), had, he thought been adopted by most subsequent observers. It was supported by Fayol's work, and had been endorsed by Threlfall and Lewes. It had also been confirmed, with certain qualifications, by recent experiments of Parr and Kressmann, in America. In 1909, there was published a "Bulletin" from the University of Illinois, containing a good deal of new work on the spontaneous combustion of coal. On the whole, he regarded it as a very well carried out investigation. The experiments were made upon Illinois coals, which were characterized by a high moisture content, and also a high pyritic content. Each sample was placed in a stone jar, the bottom of which was perforated with a number of holes. The jars were then stood in an "oven," or enclosure maintained at a uniform temperature. Free circulation of air was allowed through the holes and through the coal. A series of these ovens could be maintained at different constant temperatures of 40°, 60°, 80°, and 115° C. The amount of oxidation occurring on the coal was judged by the rise of temperature; and it was found, in a series of preliminary experiments, that the maximum rise in temperature in a given experiment was always attained within 72 hours. The sample was placed first of all for three days in the oven with the lowest temperature. It was then transferred to the next oven; and so on, until it finally emerged from the oven at the highest temperature. The experiments were made in fifteen series, the first six of which were with the object of ascertaining how far the varying content of pyrites would affect the rise in temperature observed, and also of judging at the same time the effect of wetting the coal. The first and second series were made with a coal containing 1·65 per cent. of pyrites—one with dry coal, and the other with wet. It was found that oxidation of the dry coal, as measured by a rise of temperature, occurred at 60°, but with more marked activity at 80°. At 115°, the highest point, there was a very big rise of temperature; and the rise was greater the more finely divided the condition of the coal. In the case of the wetted coal, apparently after the moisture had been driven off, there was a bigger rise observed at the higher temperatures than with the coal which had been used dry. In series three and four, with a 3 per cent. pyritic coal, the result was a more marked tendency of a coal to ignite spontaneously after it had been wetted. The fifth and sixth series, with 5 per cent. of pyrites, led to the conclusion that, while the presence of pyrites was not essential to the spontaneous oxidation of coal, yet it was a factor. The investigators said that since experiments by them showed "that the oxidation of the pyrites is practically constant—that is, about a fifth of the total pyrites present—then it follows that coals with increasing pyrites content will have a corresponding increase in pyritic oxidation, and a correspondingly greater amount of heat will be liberated." The next three series of experiments dealt with different sizes of coal; and then series ten to fourteen were concerned with the investigation of the possible deterrents. For example, they tried wetting the coal with solutions of common salt, calcium chloride, sodium carbonate, and other things, to see if deterrents could be discovered; and they found, for instance, that while a common salt solution had no appreciable deterrent effect, a 10 per cent. solution of calcium chloride, which was hyposcopic, acted as a deterrent. But a 3 per cent. solution of calcium chloride, which did not take up water, did not so act. According to their experiments, a deliquescent salt would act as a deterrent. The next thing they tried was a saturated solution of lime-water; but this did not act as a deterrent. Various other things were experimented with—among them ferrous sulphate; but witness thought the only deterrents which proved effectual were either calcium chloride solutions of 10 per cent. or upward strength or a solution of sodium hydrogen carbonate.

Further dealing with these experiments, witness said that, among the most important of the general conclusions of the investigators, the first was that the oxidation of coal was continuous over a wide range of time and conditions, and began with the freshly-mined coal at ordinary temperatures. A number of oxidation processes were involved, which were more or less distinct in character, some being relatively slow and moderate in form, while others were rapid and vigorous in their action. Witness thought this was a reasonable surmise, though they did not discover or differentiate between the various possible oxidation processes in the coal substance itself, and there was nothing in their experiments which would enable them to say definitely that there were different processes at work other than the obvious difference between the oxidation of associated pyritic matter and the oxidation of the coal substance itself. Secondly, it was said that, in general, for a given coal a point existed, as indicated by the temperature, below which oxidation was not ultimately destructive. The continuance of this point was dependent upon certain accessory conditions. If these conditions were withdrawn, the oxidation ceased. On the other hand, above this critical point, which was best indicated by temperature, oxidation was ultimately destructive, and was characterized by the fact that it did not depend for its continuance upon external conditions, but was self-propelling, or autogenous. They went on to say that the point of autogenous oxidation, while varying for different conditions, might be indicated by temperatures of the mass ranging from 140° to 160° C., in an atmosphere of oxygen, or approximately between 200° and 275° C. in oxygen diluted with nitrogen, as in air, depending to a great extent upon the fineness of division. The phenomenon of fire or actual kindling did not occur till a much higher temperature was reached, usually beyond 350° C. In the next place, it was stated that the temperature at which autogenous oxidation began was the sum of numerous temperature components, each of which, either because of its own contribution to the total heat quantity, or because of its function as a stimulus for chemical activities, must be looked upon as a dangerous factor, tending directly to the ultimate result of active combustion throughout the mass. Among the more important factors contributing towards this end were mentioned fineness of division of the coal, because it exposed more surface; the presence of easily oxidizable compounds in the coal substance itself; and the presence of iron pyrites. The last named they regarded as a subsidiary factor, but still as having possible importance. It was stated in one part of the report: "It seems, therefore, that the presence of pyrites is a much more important factor in spontaneous ignition of coal than has heretofore been ascribed to it; and its influence on the spontaneous combustion of coal cannot be discarded in the off-hand way that has been so common with some of the previous investigators, merely because of the fact that some coals containing no pyrites at all would ignite spontaneously." Another contributory factor mentioned was moisture, which they claimed was essential to pyritic oxidation. They found that in coal, with conditions otherwise favourable to oxidation, the oxidation would be facilitated by moisture. These American investigators were doing valuable work; and witness thought that any result which they said was characteristic of their experiments ought to be very carefully considered in relation to English coals, and investigations made to see if they behaved in the same way.

With regard to the oxidation of carbon and hydrogen, witness continued, the report seemed to infer that up to a temperature of 120° C. there was no actual liberation of oxidized gaseous products from the coal. Up to this temperature there was an absorption of oxygen. It might be that this absorbed oxygen was chemically combined with the coal substance; but there was nothing given off up to a temperature of 120°. Above this temperature oxidation products, such as carbonic acid and steam, did appear. The first stage was really the absorption of oxygen up to 120°. Then at this point the first signs of evolution of carbon dioxide and steam appeared—the oxidation was not sufficiently vigorous yet to be autogenous—and then at 200° it became autogenous, and the temperature rapidly mounted, until at 350°, or thereabouts, actual firing began. This seemed to be their view of the history of the process during their experiments. Witness added that he had compared this view with other recent work, and was inclined to adopt it himself. He believed, in the first place, there was no doubt that coal without pyrites was capable of absorbing, and probably entering into chemical combination with, oxygen. He did not think it was oxygen that went in and which one could get out as oxygen again. It might be well worth making careful investigation with a view to establishing whether this oxygen was merely occluded or chemically united with the coal substance to form an oxygenated coal substance. He ventured to surmise that it would be found to have actually entered into a loose chemical combination, rather than that it was present in the merely occluded form. It was the actual combination of the oxygen in this loose way with the coal substance which gave rise to the initial evolution of heat, and which served to raise gradually the temperature of the coal. In such circumstances, and to a degree dependent upon the conditions of heat conservation, the temperature would rise until the heat evolution was just balanced by radiation losses, when one would get a temperature equilibrium. It seemed to him that, provided the air supply was sufficient, there was no doubt this absorption of oxygen would increase in rapidity with rising temperature; and so the process would go on, if the heat was conserved, at a sort of compound interest rate. The activity of the process and the amount of oxygen which was finally absorbed would, of course, depend upon the character of the coal substance. Some observers had pointed out that coals contained substances of an unsaturated chemical character, such as combined ordinarily with bromine, and that these substances also absorbed oxygen. Professor Fischer, of Gottingen, said some years ago that coals which most rapidly absorbed bromine were precisely those most liable to rapid oxidation and spontaneous ignition; and as a practical test he recommended shaking for five minutes a gramme of finely-pulverized coal with 20 c.c. of semi-normal bromine solution. If the whole of the bromine had not then disappeared, it might be inferred that the coal did not contain sufficient of the active oxygen-absorbing constituents to make it dangerous to store.

Proceeding with his evidence, witness remarked that there was another curious feature to which Dr. Wheeler had drawn his attention, and said he had observed—namely, that the coals which were most liable to spontaneous oxidation were those which were already fairly well oxygenated, and therefore contained a fair amount of oxygen. He thought there was some corroborative evidence of this, though it might seem to be paradoxical. One might be inclined at first to think that a coal which had not taken up any oxygen at all would show more

readiness to take it up than another which had. In the oxidation of hydrocarbons, he thought the first oxygen atom which went in, so to speak, showed the way for the other to follow. If the same thing happened with coal, it would explain the suggestion that it was coals which had already attained a certain degree of oxidation that were most liable to take up more oxygen. This was a very interesting point, on which he thought work might be done.

Sir ARTHUR MARKHAM: It is a well-known established fact, and found by many experiments, that the greater quantity of oxygen coal contains, the greater ability it has to take up more.

Witness: I think that can be explained from a chemical point of view, though it may appear at first sight paradoxical.

The CHAIRMAN: If you made analyses of different coals which were put before you, and you were asked to pick out those which were liable to spontaneous combustion, you would, I take it, be rather prone to pick out those with a high oxygen-content?

Witness: Yes, other things being equal. If the Committee would like it, I will make a *précis* of Parr and Kressmann's paper, setting out the chief points, because I think this a very important investigation.

The CHAIRMAN said the Committee would be glad if, at the same time, Professor Bone would sketch the lines of the investigation which they should follow from the chemical point of view.

Mr. RHODES: Do Parr and Kressmann arrive at any very definite conclusions as to the antidotes that should be adopted to abate the condition of things which you set out?

Witness: Yes, they make certain recommendations; but these rather have reference to the carrying of coal on ships, and so on, and to its storage. I do not think they have specially considered the subject from the point of view of fires in mines.

Mr. *George Knox*, Professor at the Mining School in Wales, next submitted some suggestions as to the lines on which further investigation should be conducted. First of all, there was the affinity for oxygen which coal was known to have, and the power of conductivity of heat, which was most important from the chemical point of view. Oxidation was very much more rapid in a mine than it was on the surface; and this was a feature worth inquiring into. From experiments on a big scale, and carried out over a considerable period, Taffanel gave it as his opinion that the oxygen absorbed was three times (and in exceptional cases six times) as great underground as it was at the surface. A combined geological and chemical inquiry might have some bearing upon the point which had been raised by various people—particularly by Dr. Harger recently—that the initial heating might in some way be due to the composition of the coal itself through bacterial and fermenting actions. Dr. Harger seemed to think that some bacterial action might still be going on in a mine; but, of course, this could not account for heating beyond about 60° C., because they died off then. The second point was the relative inflammability of coals and the nature of the gases produced before ignition took place. He thought the relative proportion of humic substances in coals had a great deal to do with the point at which they would spontaneously ignite. Then there was the temperature at which the oxidation became destructive; and his fifth point was the moisture-content of the various coals, and its effect as an oxidizing agent. By the moisture content, he meant the moisture inherent in the composition of the coal—not damp coal. This was an important point, because oxidation seemed to be more rapid with coals having a very high percentage of hygroscopic moisture. His sixth point was the temperature and humidity of the air in various parts of the mine; and he proposed that they should be taken regularly over a long period, and an inquiry made as to their action as oxidizing agents. All these points really ought to be grouped together, as being work that could be jointly done by a body of men representing the microscopic, geological, mining, and chemical sides. He was aware of the work of Dr. Bedson in classifying coals from the point of danger, in proportion to the solubility of certain hydrocarbons by pyridine. This was useful; and if taken with the work that was being done geologically, it would be still more important. The action of pyridine was in direct proportion to the amount of resinous material in the coal. Then the last point he put forward for investigation was the relation between subsidence crush and heating of finely-powdered coal dust. With a coal liable to spontaneous combustion, the liability was increased if fine coal was mixed with the larger pieces.

Evidence was afterwards given by several Inspectors of Mines, colliery managers, and miners.

GAS-METER TESTING AT MANCHESTER.

The Abolition of the Index-Test.

A Special Meeting of the Justices for the City of Manchester was held in the Grand Jury Room of the Sessions House of Friday; the principal business being: (1) To consider correspondence submitted by the Gas-Meter Testing Committee; and (2) to receive the annual report of the Official Inspector of Gas-Meters (appointed under the Sale of Gas Act) for the year ended March 31, and the statistical returns in connection therewith.

In the "JOURNAL" for Feb. 29 and March 7 [pp. 491, 552] the abolition of the index-test at Manchester was referred to; the controversy having arisen out of a decision of the Manchester Gas Committee, at the February meeting, to discontinue what was termed the "double test." This decision was duly communicated to Mr. T. A. Wilby, the Clerk to the Justices, who replied that the resolution was subversive of a financial arrangement of some fourteen years' standing, which was entered into with a view to assisting the Justices' Gas-Meter Inspection Committee in the full examination and testing of meters; and he had deemed it necessary to call a special meeting of the Justices' Committee to consider the situation arising therefrom. Voluminous correspondence followed between the Chairman of the Justices' Testing Committee (Colonel H. T. Crook, D.L.) and Mr. F. A. Price (the Superintendent of the Gas Department), the former asking for information as to the reasons which had moved the Committee to this action.

To this communication, Mr. Price replied that the Gas Committee decided to discontinue the testing of the indices of meters, not only on the grounds of economy, but also having regard to the apparent uselessness of the test, after many years' experience. To expend £400 a year on a test not required by the Gas Act, or any other Act of Parliament, was unanimously felt by the members of the Committee to be an unnecessary waste of public money, especially as no other corporation gas undertaking had followed the example of Manchester in the matter. In reply to a letter from the Clerk to the Justices' Testing Committee asking for a conference for the purpose of discussing the resolution, Mr. Price intimated that the Chairman of the Gas Committee did not see that any good could come out of a conference such as was suggested by the Justices' Committee, as he could hold out no hope of a reversal of the decision arrived at by the Gas Committee at their previous meeting. In a subsequent letter, he reiterated that the matter had been closely gone into by the Gas Committee; and that after further consideration of the matter, and the requirements of the Gas Acts, it had been unanimously resolved—"That the decision of this Committee with regard to the testing and stamping of meters be confirmed." The Clerk to the Justices' Testing Committee, on receipt of this communication, intimated to the Superintendent that a special meeting of the Justices' Committee would be called to consider it. In the meantime, he forwarded copies of the proceedings of a former conference which took place on July 4, 1901, between the Gas Committee, certain manufacturers of gas-meters, and the Justices. Two days later, a special meeting of the Justices' Testing Committee was held, and on Feb. 28 Mr. Price received a communication, in the course of which it was stated that the Justices' Committee regretted that the Gas Committee thought no good would come out of the proposed conference; for, in the view of the Justices' Committee, the resolutions of the Gas Committee seemed to imply some misapprehension of the relative functions of the two—a misapprehension which in all probability would have been removed by a friendly discussion at the proposed conference. The Justices' Committee could not conceal their surprise that retrogressive action of the nature implied by the resolution should have been decided upon without previous consultation or any intimation that such a step was contemplated. Under the circumstances, they felt it incumbent to make the position clear, which they proceeded to do at length.

It was contended that, with few exceptions, the administration of the Act had been ineffective in safeguarding the public against errors in the registering apparatus, which, though not frequently found, were, when they occurred, much greater in amount than any other class of error. Errors exceeding 10 per cent. were rarely found in the body of the meter; but when they occurred in the registering apparatus, it was exceptional to find anything less than 25 per cent., and 100 per cent. of error was the most common. The records of the Manchester Justices' station showed that, of these gross errors, more than two-thirds were against the consumer. The anomaly that meters in which there were such errors should be passed and officially sealed as correct had long been a source of much dissatisfaction to inspectors and statutory committees; and many efforts had been made to remedy it. For fourteen years the meters used by the Manchester Corporation in the sale of gas had been subjected to the more complete test; and the station was equipped with the necessary plant for index examination and testing. Meters were received from outside districts for complete testing, for which the additional fees were readily paid. The practice of index examination obtaining so long at the Manchester station was now generally regarded as essential by those concerned with gas-meter testing; and so the Justices' Committee thought it would be greatly against the public interest that any step should be taken inimical to its continuation. After a Board of Trade conference on the subject, a Bill was drafted in 1909 to amend the Gas Act, so as to require the testing of meters to be completed by the examination, and, if found correct, the separate stamping of indices, almost exactly on the lines adopted by the Manchester Justices' Committee. Owing to the pressure of business in Parliament, the Bill was not introduced. It showed, however, the conditions which would have to be complied with in the manufacture of meters if the necessary amendment became law. By the arrangement between the Manchester Corporation, the Justices' Committee, and the manufacturers of meters, most of the modifications necessary for facilitating the examination and stamping of the indices had been made. One of them was the provision of an additional cup for the seal or stamp, denoting that the index had been examined. In the Corporation form of contract for automatic meters, the consumer agreed to pay for all gas registered by the ordinary index of the meter, as stamped by the Government Inspector. Should the action of the Corporation Committee lead to the manufacturers of meters reverting to the older type without this provision, the absence of the second seal would indicate to the consumer that the index had not been examined. It was conceivable that this would cause some dissatisfaction. The number of cases of error discovered by any authority for the verification of standards was no measure of the value of the work of such authority. There could be no question that the establishment of the meter-testing station by the Gas Act brought about a great improvement in the manufacture of gas-meters, and a corresponding decrease in the number of incorrect meters. The imposition of the index-test had operated in a like manner. There was no question but that the makers of meters exercised the greatest care in their construction, and that errors of any kind in new meters were not numerous; but this was no reason for discontinuing the verification of their correctness by an independent authority.

Two days later (March 1) the City Council approved the action of the Gas Committee; and notice was given to end the "double test" on March 31.

CONSIDERATION OF THE CORRESPONDENCE DEFERRED.

At the meeting of the general body of Manchester Justices on Friday last, the Lord Mayor (Mr. Thos. Smethurst) presiding,

Colonel CROOK said that since the correspondence had taken place they had had an intimation from the Finance Committee of the Corporation that they wished to receive a deputation from the Justices' Committee for a joint conference with the Gas Committee. They now

had definite assurance that the Gas Committee would attend the conference; and in these circumstances he thought it would be as well if they deferred the consideration of the correspondence, and the annual report of the Inspector (Mr. S. Dyson), to the next quarterly meeting, when doubtless the three Committees concerned would have met one another and discussed in a friendly way the present position of affairs. He deplored a controversy of this character at a time when the nation was engaged in most important work.

Mr. H. N. Barrow seconded.

Alderman Kay said that probably some little explanation was advisable on the foregoing correspondence; and he quite appreciated Colonel Crook's attitude in the matter. He would be very pleased to lay the information in the possession of the Gas Committee at the disposal of the Justices' Testing Committee—information which was the reason of the action taken by the Gas Committee. He hoped that nothing but success would come of the conference between the three Committees referred to, and added that he thought it better to have a conference among themselves privately, rather than deal with the matter publicly.

Colonel Crook said this met his view absolutely.

The Lord Mayor: I hope that the result of your conference will be a happy issue out of all our difficulties.

Annual Report of the Official Inspector.

In his report dealing with the work of the past twelve months, Mr. S. Dyson (the Official Inspector of Gas-Meters) says that the number of meters tested during the year was 39,263, showing a decrease of 1403 as compared with the previous year; the fees charged (£1627) being an increase of £12. The expenditure for the same period amounted to £1987, showing a debit balance of £360.

Of the meters tested, 1655 were rejected, or 4·21 per cent. Of the 4625 wet meters tested, 87, or 1·88 per cent., were rejected; and of 34,638 dry meters tested, 1568, or 4·52 per cent., were rejected. The number of prepayment meters tested during the year was 19,898, or 50·5 per cent. of the total meters tested.

Twenty years ago, and on many subsequent occasions, he reported upon the necessity for the amendment of the Sale of Gas Act, 1859, so as to require that the registering apparatus of meters shall be adequately tested. A meter with accurate measuring chambers may be passed as correct by the inspector, while its index registers incorrectly through some defect in the gear. Cases of this kind have occurred in Manchester; and in January, 1900, a 20-light meter was tested in the department, and found correct by the proving wheel. The index was afterwards tested at the request of the gas consumer, who had disputed his gas bill; and the index was found to be registering 233 per cent. fast.

The index test was instituted in the department in July, 1902, and since then over 900 meters have been rejected for index errors, or an average of 64 per annum; but for the first three years after the institution of the test the average was 143. The most serious errors ranged from 150 per cent. fast to 100 per cent. slow. Several of these meters had been removed from consumers' premises, and were submitted for re-verification; they having been previously stamped as being correct, having only been examined by the limited test of the proving wheel. In the majority of cases, however, meters were submitted for testing by the makers; and the errors were detected by the application of the index test before the meters were fixed and used for the sale of gas. These meters would undoubtedly have been stamped as correct if the index test had not been applied.

The imperfections of the Sale of Gas Act, 1859, became apparent shortly after its introduction; and from time to time efforts have been made by various authorities, including the London County Council, to secure its amendment. The Manchester Testing Committee have for many years advocated its amendment. In 1908, a Departmental Committee was appointed by the Board of Trade; and meetings were held at the offices of the Standards Department to consider the proposed amendments of the Act. Mr. Dyson, being a member of this Committee, says he has reason to believe that the compulsory testing of gas-meter indices was included in the Draft Bill for the amendment of the Gas Act; but owing to the pressure of business in Parliament, the Bill was not introduced. The necessity for the proper examination and testing of the indices of gas-meters is, he adds, clearly shown by the City of London (Various Powers) Act of 1914, by which the Corporation got powers to enforce the proper testing of high-pressure gas-meters; the test under the Gas Act of 1859 being quite inadequate. In the Act, the examination and testing of indexes is compulsory; and the indexes must be so constructed as to be detachable for these purposes.

Gas Profits at Blackpool.—During the financial year just ended, the Blackpool Corporation Gas Department made a net profit of £12,000, after allowing £14,600 for loan charges. The surplus is available for appropriation in relief of the rates, reserve fund, &c., as against £2000 estimated at the beginning of the year, and £8800 profit in the preceding year. This satisfactory profit has been obtained notwithstanding the effects of the restricted lighting order and the increased cost of coal, labour, and war bonuses. The price of gas was raised last year from 2s. to 2s. 6d. per 1000 cubic feet. The total income was £116,760, as against the estimate of £94,000, and £100,000 actual in the preceding year.

Ministry of Munitions and Salford Gas Testing.—At the last meeting of the Swinton and Pendlebury District Council, the receipt was reported of a letter from the Ministry of Munitions, intimating that they had served notice on the Salford Gas Committee requiring them to extract certain products from the gas, and that the result might possibly be a diminution of illuminating power. In view of this, the Ministry of Munitions were of opinion that the Salford Corporation should not be required, under the circumstances, to comply with the illuminating standard imposed by law. It was ultimately decided that, so long as the requisition from the Ministry of Munitions remains in force, the testing of gas supplied to the Swinton and Pendlebury district by the Salford Corporation be suspended.

GAS FROM TURF.

According to a "Central News" telegram from Copenhagen, the coal famine in Denmark has forced several prominent towns to close their gas-works and extinguish the street-lamps. Practical scientific experiments carried out in order to produce gas from turf (of which Denmark has great quantities) have yielded satisfactory results. The first towns in Jutland have already re-opened their gas-works with turf instead of coal.

Referring to the above-quoted telegram, the Engineering Correspondent of the "Daily Telegraph" wrote: The use of turf for gas production on such a scale that gas-works can be operated "with turf instead of coal" is decidedly interesting. It may be assumed that the turf employed is closely allied to peat—a material to the use of which in special gas-producers engineers have given much attention in recent years. Peat gas, however, must be a poor illuminant compared with coal gas. It contains only about 35 per cent. of inflammable gas, as compared with 92 per cent. in the case of coal gas. Consequently, the light obtained will be very poor, unless a much greater quantity of peat gas is burnt. Its high percentage (four times as much as in coal gas) of carbon monoxide would make its use for domestic purposes decidedly risky. For the purpose of power production peat gas would seem to be more suitable than for illumination. In Germany many large electricity generating stations are run by gas-engines deriving their energy from peat-gas producers. The producers are of a special type, differing appreciably in design from the ordinary gas-producer running on anthracite, coke, or bituminous coal. If the "practical scientific experiments" referred to in the telegram have shown it to be possible to use turf or peat in an ordinary gas-producer, they are certainly of considerable importance.

AIR-RAID PRECAUTIONS IN EDINBURGH.

In spite of the fact that the streets of Edinburgh have for weeks been in almost total darkness, it was a surprise to the majority of the citizens when warning was given (by means of a reduction of the electric current and the stoppage of traffic) on the night of April 2 that Zeppelins were heading for Scotland, for most had concluded that the Germans would prefer taking shorter trips and attacking more densely-populated districts. The Hun, however, like most barbarians, is enigmatical. Immediately after the raid on the Scottish south-east coast (the Press Bureau forbids more explicit language), gas consumers in the capital city asked the very natural question, "Can nothing be done to warn us?" Committees of the Council discussed the general question of warning. Opinions, as usual, were sharply divided. Some favoured sound signals, which would inform all alike; some advocated no warning at all (a view taken by the Chief Constable); but all agreed that it was not fair to warn electric light users and pass over the more numerous class of gas consumers.

As already mentioned under "Notes from Scotland" [*ante*, p. 149], the Council held a private meeting and debated with representatives of the Gas Commissioners the practicability of warning their consumers, the upshot of which was that the Commissioners were requested to carry out experiments with the object of ascertaining the percentage of pressure-reduction that could, with safety, be made. While, presumably, arrangements were in hand for these tests, a letter was received from the military authorities giving definite orders, on receipt of a certain message, "to reduce the pressure of the gas in the mains and service-pipes as much as is consistent with public safety." A meeting of the Commissioners quickly followed the intimation, at which the Engineers were instructed to reduce the pressure on the following Thursday, between 9 and 9 30 p.m., and to report the result of the experiment. It was essential for the success of the trial that it should be well advertised. The following notice, therefore, appeared daily in each of the local papers; and frequent editorial references were made to it:

AIR-RAIDS.

Instructions, issued under authority of the Defence of the Realm Acts, have been received by the Edinburgh and Leith Corporations' Gas Commissioners to reduce the pressure of gas when required as a warning of anticipated air-raids.

The Commissioners have to-day authorized their Engineers, between 9 and 9.30 on Thursday evening, the 27th curt., to reduce the pressure to a certain extent so as to ascertain what reduction can be effected with safety.

The gas consumers are accordingly advised that they should watch their lighted gas-jets and other apparatus between 9 and 9.30 on Thursday evening, the 27th curt., and any gas consumer whose gas supply is seriously affected by the reduction of pressure is respectfully requested to communicate at once by card with the Engineer and Manager at 18, Calton Hill, Edinburgh.

By Order,
James M'G. Jack,
Clerk.

25, Waterloo Place, Edinburgh,
April 20, 1916.

This announcement led to much newspaper correspondence. Scribes explained, more or less clearly, why the total cutting-off of the gas would be dangerous, or pointed out why gas pressure at high levels is greater than at low levels; and there was displayed the not uncommon spectacle of half-informed or quite ignorant persons posing as teachers. "The anxious correspondents," observed the "Evening News," "who are flooding us with letters about pipe-levels and gas pressures and the like, in view of the experiment to be made on Thursday evening in Edinbugh with a 'gas warning,' should possess their souls in patience. Time enough after the experiment to give their experiences and impressions, if they are of any practical value."

On April 22, the Magistrates took the proposed experiment into consideration. They agreed that there was a class of citizens who would not see the Press announcements, and they therefore decided to

instruct the police to distribute among these people copies of the advertisement. Two days later the Commissioners met again, and were informed by one of their number that it had come to his knowledge that many gas consumers, apprehending danger from the reduction of pressure—a technical expression not free from mystification to some minds—intended to extinguish their lights, &c., when the clock struck nine on Thursday, and so unintentionally defeat the object the Commissioners had in view. He thought that it should go forth that this was the opposite of what was desired, and that consumers should use their burners and other appliances as usual. This was duly reported and emphasized by the local Press. Nevertheless, it is quite likely that a considerable number of the more timid consumers did not act upon the advice, and so may have discounted the value of the test.

Since the above was written, we have ascertained that the pressure was diminished by 30 per cent., with results scarcely (if at all) noticeable. "Edinburgh, owing to variations in the distributing area, is very differently situated from the bulk of English towns" [we quote from what has the appearance of being an official explanation], where such experiments have been carried out with great success. A reduced pressure which would be more than sufficient for the low-lying parts, would have scarcely any effect on the higher levels. . . . It may be taken for granted that the 30 per cent. reduction was well within the range of safety, and that a much larger one can be undertaken without danger." A report having been made to the Lord Provost, he authorized a second and bolder experiment for yesterday (Monday).

NELSON CORPORATION GAS DEPARTMENT.

Mr. Dugald Currie, the Engineer and General Manager of the Nelson Corporation gas undertaking, has presented his first annual report to the Gas Committee, dealing with the work done and the results obtained during the year ended March 31.

The expenditure on revenue account amounted to £48,814, and the income to £68,614, leaving a gross profit of £19,799, and a net profit of £3572, which compares with £5299 for the previous year. The quantity of coal carbonized was 30,928 tons, the total cost of which delivered at the works averaged 16s. 6d. per ton, as against 14s. 3d. per ton for the year before. The wages paid (53 pay weeks) were £9785, including £416 to dependants of employees with the forces; whereas in the previous year (52 pay weeks) the total wages were £10,445, of which £175 was paid to dependants. The number of men employed varied from a maximum of 106 in winter to a minimum of 93 in summer; the figures for the preceding year being 126 and 116. There are at present 21 employees serving with the forces, including three members of the office staff.

The make of gas (all coal gas) was 427,340,000 cubic feet, or 13,817 feet per ton of coal; the make for 1914-15 being 415,541,000 cubic feet, or 13,496 feet per ton. The total quantity of gas delivered during the year was 427,084,000 cubic feet—an increase of 11,141,000 feet, or 2·67 per cent. The unaccounted-for gas was 3·95 per cent., which was considerably less than a year ago. Of a total of 15,035 consumers (an increase of 87 during the year), 6388 have ordinary meters, and 8647 prepayment meters.

The gross income from residuals and bye-products was £16,054, as compared with £13,148 obtained the previous year; and after deducting all expenses of manufacture and handling same, the net income from this source amounted to £13,797, as compared with £11,232. This gives a return of 8s. 11d. per ton of coal carbonized, making the net cost of coal 7s. 7d. per ton, delivered at the works, as compared with 6s. 10½d. for 1914-15, and 6s. 7½d. two years ago. During the past year, £7926 was charged to capital account, but £10,472 of capital was repaid. The net capital outlay per million cubic feet of gas made now stands at £295, as against £309 a year ago.

After remarking that the vertical retort installation at the Brierfield works has now been in constant operation for fully a year, and the results obtained are satisfactory in every sense, Mr. Currie says that, having regard to the abnormal conditions prevailing during the past year, it is pleasing to observe that the working has turned out so satisfactory. Very great difficulty was experienced during the winter months in obtaining adequate supplies of coal, acid, and other raw materials and stores. The position in regard to coal supplies was further aggravated by the fact that, out of almost 31,000 tons carbonized, only one-third of the quantity to be delivered was purchased at the increased prices, with the result that colliery owners were most reluctant to forward supplies at from 5s. to 6s. per ton less than they were obtaining from other sources under new contracts. With proper foresight, large quantities were obtained and stored during the summer months, which enabled the department to surmount the difficulties experienced during mid-winter. Sulphuric acid was also most difficult to obtain; and, notwithstanding that the price charged from April 1 to Dec. 31, 1915, was £3 6s. 9d. per ton, the price was increased without notice on Jan. 1, 1916, to £8 per ton. This price remained in force until Feb. 15, when the Ministry of Munitions fixed maximum prices enabling supplies to be bought at an average of £4 11s. 3d. per ton.

The estimates for 1916-17 are based on the assumption that the quantity of gas manufactured will be the same as during the past financial year. In the expenditure, it is estimated that coal will cost £7000 more, acid £245 more, income-tax £2500 more, and interest and sinking fund charges £1000 more. The total expenditure is estimated at £74,523; and the total income at £69,124, showing a deficit balance of £5399, to which have to be added various sums, making the total estimated deficit £6174. To meet this deficit, Mr. Currie points out, it would be necessary to increase the price of gas for all purposes 3d. per 1000 cubic feet, which would bring in about £4800 additional revenue; and by increasing the price of coke 1d. per cwt., the total deficit would be met.

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THE introduction of the ***New*** Main Cooker marks a great advance in cooker construction. A salient feature is the treble-crowned oven packed with non-conductor which reduces loss of heat to a minimum. There are many other features which will interest you. Send for particulars or, better still, a sample, which will convince you.

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ROCHDALE GAS AND WATER UNDERTAKINGS.

The Finance Committee of the Rochdale Corporation met last Thursday, to consider the financial position for the twelvemonth ended March 25. Substantially increased gas profits were reported—£11,454 over those of twelve months ago—and a slightly decreased deficiency on the water undertaking. Anticipations as to there being a heavy deficit from the operations of the water department were accordingly agreeably disappointed. The result is due partly to an improvement in the revenue of the department (£2250), whereas working expenses have only increased £744. The deficit to be met out of the rates is £4045, against £4115 a year ago.

At the last meeting of the Gas Committee, it was reported that the profit on the undertaking for the year was £14,955, as compared with £3501 twelve months ago, when, for the first year in the history of the undertaking, no contribution was made to the relief of the borough rates. A decade earlier, the largest amount ever allocated to the rates (£19,598) was given; and altogether £225,000 has been handed over to the rates from gas profits during the last two decades. The management has had to face very heavy expenditure during the past twelve months, especially on coal; but to meet this the price of gas was raised a year ago, and yielded £15 875. The total receipts for the financial year just ended were £120,313, as compared with £95,661, or £24,652 more than twelve months ago. Working expenses amounted to £91,547, against £79,510, an increase of £12,037. The gross profit, after paying working expenses, amounted to £28,675, as compared with £16,151. From this profit interest and sinking fund charges, amounting to £12,437, and half-wages to men with the Colours, and war bonus, amounting to £1372, are to be deducted, leaving a net profit of £14,955—an increase, as already stated, of £11,454.

The yield from residuals during the past twelve months was £9485, against £9314. In addition, £8962 was obtained from sulphate of ammonia, or £1936 more than in 1914-15. Sales of coke brought in £17,790, an increase of £7707. The cost of street lighting, due to restrictions, was £5261, against £6850. The capital value of the gas undertaking is £259,343, and the sinking fund £77,871, against £73,536 a year ago.

It is pointed out in the report that, by resolution of the Council some years ago, the first charge on net profits is a payment of £6000 a year to a renewal fund—£4500 allocated to reserve, and £1500 as a working balance. This allocation the Gas Committee decided to make at their last meeting, thus reducing the available surplus to £8955. From this amount a further £2498 had to be taken to wipe out a debit balance brought forward from last year. There was thus but £6457 of net profit available; and a proposal was made that £6000 of this should be applied to the relief of rates. But no member of the Committee seconded the proposal, which eventually fell through; and the meeting decided to recommend £6457 being put to the reserve.

Subject to the approval of the Town Council, at the meeting on Thursday, the Finance Committee eventually induced the Gas Committee to contribute £1514, the equivalent of a penny rate, out of the surplus of £6457; and they agreed to do so. This, of course, reduces the amount to be placed to reserve fund to £4943. Nothing is proposed to be taken from the electricity surplus (£2537).

THE PAST YEAR AT BLACKBURN.

In the last number of the "JOURNAL" [p. 187], there were reproduced the main points of the first annual report of Mr. A. Morton Fyffe, the Engineer and General Manager of the Blackburn Corporation Gas Department. Mr. Fyffe pointed out that the gas supply is only being maintained with great difficulty, owing to the condition of the plant, that economical and efficient working is impossible under present conditions, and that to improve these conditions it will be necessary to expend considerable sums of money on renewals and on the introduction of modern plant.

The report was alluded to recently at a meeting of the Blackburn Chamber of Commerce, when the President (Mr. H. le Moine), turning to local affairs, said he was pleased to see the Gas Department had been able to declare a profit of £5229 on the twelve months. This, in view of the reduced consumption owing to lighting restrictions and the deficits of the previous two years, was very satisfactory. He hoped the new Engineer and Manager would soon feel that he had the works in such a state of efficiency that the Gas Committee would be able to regard themselves as having weathered the storm, and look forward to increasing profits. Other speakers expressed themselves in cordial agreement with this; but there was not the same unanimity when the President said that he hoped the Finance Committee, when fixing the borough rates for the year, would take into account the profits of the Gas Department and the Tramways Department, and also the curtailment of improvements and expenses during the coming year.

On the other hand, a local authority has pointed out that, although "this is a difficult time to obtain permission for the outlay of public money, even on works of such necessity as this, it may be taken for granted that the Gas Committee will take the first opportunity of giving officials and employees alike a full and fair chance 'to make good' at the gas-works, and repair the errors and shortcomings of the old *régime*."

Our Lancashire Correspondent adds that the feeling in the district is that Mr. Fyffe is to be congratulated upon the character of his first annual report, and that the policy upon which he is insisting—the expenditure of money on renewals and the introduction of modern plant—is the only way in which an efficient and economical solution of Blackburn's gas problem is to be found. At this stage in the history of the undertaking, to talk of taking away and applying gas profits to the relief of the borough rates, when the money is needed for improvements and extensions in the Gas Department itself, sounds very much like "robbing Peter to pay Paul."

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ROTHERHAM CORPORATION GAS UNDERTAKING.

Annual Report of the Engineer.

In his report to the Gas Committee on the results of the operations for the year ended March 31, Mr. J. S. Naylor, the Engineer and General Manager of the Rotherham Corporation gas undertaking, states that the quantity of coal carbonized was 24,270 tons, at a cost of £17,471, or 14s. 4·75d. per ton, as against 27,050 tons for the previous year, costing £16,751, or 12s. 4·62d. per ton—an increase of 1s. 11·87d. per ton. The gas made was 325,364,000 cubic feet, against 352,931,000 feet, being a decrease of 27,567,000 cubic feet, or 8·47 per cent. The make per ton of coal carbonized was 13,406 cubic feet, as against 13,047 feet, being an increase of 359 feet per ton. This make per ton constitutes a record for the department. The quantity of gas sold was 289,598,000 cubic feet, against 316,992,000 feet, being a decrease of 27,404,000 cubic feet, or 8·64 per cent. The decrease was entirely due to the restricted lighting. The unaccounted-for gas was 32,890,000 cubic feet, or 10·05 per cent. of the make, as against 32,904,000 feet, or 9·28 per cent. The works and plant had been maintained in good repair and thorough working order out of the year's revenue. The prices of residuals had varied considerably. While coke realized much higher rates than was anticipated, tar showed a considerable falling off. Liquor was somewhat better, owing to the high price of sulphate of ammonia.

The cost for public lighting, including wages and maintenance of lamps, amounted to £2737, as against £4799 the previous year, being a decrease of £2062. The cost of gas for public lighting was £1025, as against £2760. This decrease was due to the restrictions enforced by the Home Office under the Defence of the Realm Act. The balance in the bank on March 31 was £7054, as against £1867. An ample sum had been allowed for depreciation. The amount of gross profit was £16,449, as against £16,146, being an increase of £303. The net profit, after allowing for interest, redemption instalments, and contributions to the sinking fund, is £7080, as against £6600, an increase of £480. If the gas for public lighting (£1025) is again given by the department as in former years, and a sum of £1300 set aside as provision for excess profits duty, there will remain an available surplus profit of £4755, being an increase of £915.

LOW-TEMPERATURE CARBONIZATION OF COAL.

[From "Engineering," April 21.]

The theoretical advantages of low-temperature carbonization of coal, which have formed the subject of numerous lectures and papers during recent years, have attained to high practical importance since the war began. The demands of the Government for the various raw materials of high explosives have obliged the gas companies to discontinue the manufacture of water gas, and to confine themselves to the use of coal alone, with the result that the output of coke has increased, and it has become a matter of difficulty to find customers for it. Gas coke falls between two stools; it is not hard enough for metallurgical purposes, and it is somewhat too hard for domestic needs. It has, of course, a fairly defined field of usefulness, but this is limited; and it is not easy to widen it except by a greater reduction of price than the companies care to give. What the Government needs is tar, and not either coke or gas; and high-temperature carbonization, such as is conducted in a gas-works, is not favourable to a great yield of tar. Low-temperature carbonization, on the other hand, yields a great amount of tar rich in many of the bodies which are in special demand just now; while the coke, when the process is successfully conducted, is admirably fitted for domestic uses, as it lights readily and burns with a flame.

According to Professor Bone, low-temperature distillation (say at 400° to 500° C.) has the effect of decomposing the smoke-producing resinous constituent of coal. The tars obtained are richer in light oils than ordinary gas-works tars, and contain paraffins and naphthalenes, as well as benzenes and phenols. The gas obtained is smaller in volume, but richer in its content of methane and paraffins. Mr. Harold Moore, M.Sc., speaking before the Manchester Association of Engineers last February on fuel-oils from coal [see "JOURNAL" for March 14, p. 587], said horizontal gas retorts yielded 5¼ per cent. by weight of tar from the fuel used; coke-ovens yielded 4 to 5 per cent.; while the low-temperature processes yielded 10 to 20 per cent.

The following is an estimate (not by Professor Bone) of the residual products from the tar resulting from the low-temperature carbonization of 200 tons of coal:

Sulphate of ammonia	2·68 tons
Benzol, 90s.	62½ gallons
Toluol, 90s.	82 ,,
Xylol, 90s.	21 ,,
Solvent naphtha	63 ,,
Heavy naphtha	163 ,,
Carbolic acid	48 ,,
Cresylic acid	507 ,,
Creosote	460 ,,
Lubricating oil	180 ,,
Diesel-engine oil	190 ,,
Total	1776½ gallons
Pitch	9 tons

In addition, the rich gas produced can be washed for benzol, toluol, and xylol—the quantities obtained being put at 600 gallons, 100 gallons, and 20 gallons respectively. The importance of benzol as a motor fuel is very great; for not only does it serve our present enormous needs, but it also aids in maintaining the balance of trade, which is heavily against us.

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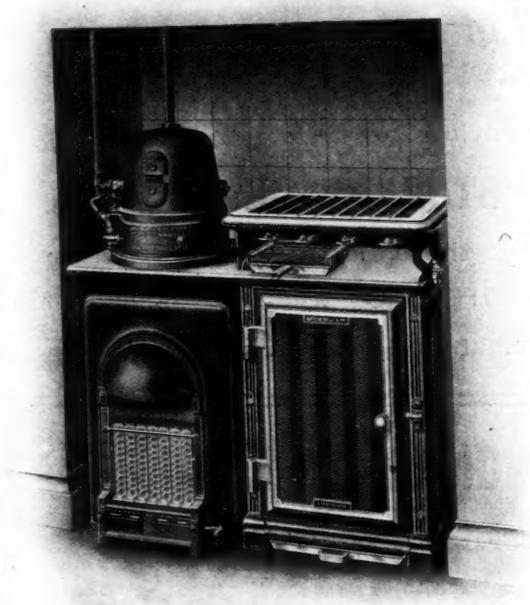

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many difficulties, as numerous persons have found to their cost; and, in addition to the technical difficulties of the process itself, there is the question of educating the public in the use of an unaccustomed fuel, and in gaining the zealous co-operation of tar-distillers and others, who have to adapt themselves to new products. There is reason to believe, however, that these difficulties are fast disappearing; for the Treasury is giving financial assistance to the building of a large carbonization works at Barnsley. A 50-ton unit is nearly completed at the works of the Old Silkstone Collieries, Barnsley. A tar-distilling and benzol-recovery plant is being erected, and arrangements are being made with the Yorkshire Electric Power Company to take the bulk of the washed gas for fuel purposes. The coke is, of course, to be sold.

The experiment, it will be seen, is to be conducted on a really commercial scale, and under the most favourable conditions; for there is, during the war, a most ample demand for all the products, except the lighting gas, and, as explained, a market has been found for that. The colliery has, it is stated, undertaken to supply up to 200 tons of suitable slack per day.

There is, we understand, a project on foot for another works, representing a combined manufacture from which there will be little or no residual coke. The scheme is to use low-temperature carbonization as the first stage in a manufacture of which the final outcome will be tar products, electric energy, and artificial nitrogenous fertilizers. It is intended that the station shall supply current for lighting, as well as for the furnaces; and so it will have a load factor of 60 per cent. or more. The fertilizer process is the one that starts with the production of calcium carbide, of which one of the constituents is coal in some form, and ends in cyanamide, which is capable of many transformations. The gas will be used for power generation, and the coke in the carbide furnaces.

EMPLOYMENT OF WOMEN AS METER READERS AT MANCHESTER.

Reference to the decision of the Manchester Gas Committee to engage, on probation, six women as meter readers, on temporary employment only, in anticipation that some of the regular meter inspectors will be required for service with the forces, was made in the "JOURNAL" for March 14 last [p. 599]. These six women have now started to put their training of the last few weeks to the test. The uniform consists of a dark grey Norfolk coat and skirt. On the collar the word "Gas" and a number are inconspicuously embroidered. The Committee decided that all the women must be not less than 25 years of age; and, all things being equal, preference is given to widows of employees in the department who have lost their lives in the war. The women have been trained for their duties by male inspectors; and they will at present act is the suburbs only—warehouses, works, and offices being left to the experienced male employees, as heretofore.

TRIBUNALS AND EXEMPTION APPLICATIONS.

At the local Military Tribunal, the Coatbridge Gas Company applied for the exemption of a man who was partly employed as chauffeur and in fitting-up gas-stoves, besides having other duties inside the works. Mr. Thomas Wilson (the Manager) informed the Tribunal that his staff had already been greatly reduced by enlistments for the war, and that, being now a controlled establishment, supplying 250,000 feet of gas to local munition works daily, it was important that there should be no further reduction. Indeed, he had had to apply to the Ministry of Munitions for more men, owing to labour troubles and the war. The Military Representative opposed the appeal, on the ground that the man was not indispensable; but Mr. Wilson said he had found it impossible to get anyone capable of filling his place. The Tribunal decided to allow exemption until June 4.

What was considered to be an important trade union test case was heard on Friday at the Manchester Tribunal, when absolute exemption for the District Secretary of the Warrington branch of the Gas-Workers' Union (Mr. Charles Dukes) was applied for by Mr. J. R. Clynes, M.P. (the Lancashire Secretary of the Union). The appeal was an employers' one for absolute exemption—the reasons adduced being that Mr. Dukes had to attend each week to a variety of questions relating to trade disputes, wages questions, and labour conditions; that the speedy and peaceful settlement of these contributed to smooth and efficient working in munition shops; that he had to visit firms and meet employers on accident and compensation claims; that more than 6000 members in the district (Warrington) had joined the army, and numerous questions received from them required his attention; and that he dealt, also, with cases under the National Insurance Act, and his duties could not be performed by a youth or woman, or by anyone not trained to them. Mr. Clynes explained that the man's work required a great deal of knowledge of labour conditions. A Member: Cannot you bring men from other centres to do this work? Mr. Clynes: Branches have already been closed; and you cannot dislocate a whole organization. A discussion ensued regarding the nature of the appeal; the Chairman being of opinion that they could not proceed any further with the case. The appeal was disallowed.

A Heavy Gas Leakage.—There was some comment among the members of the Bedwellty Urban District Council, on the submission of the Auditor's report, which stated that 31½ per cent. of the gas made was unaccounted-for in the year ended March 31, 1915. It was pointed out by the Chairman (Mr. J. Tillott) that there had been a good deal of subsidence in New Tredegar; and the Manager (who has been appointed since the period dealt with in the accounts) reported that there had been serious leakages, which had been discovered and remedied. It was decided to allow the matter to stand over until the report for 1916 had been received. It was also resolved to place the Surveyor at the head of the Gas Department.

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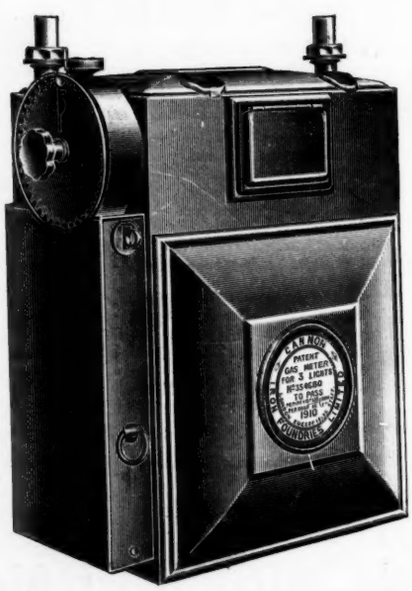

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NOTES FROM SCOTLAND.

New Gas Supply at Aberdour.—The new gas supply is now in full operation at Aberdour, Fifeshire. The Gas Company had to lay mains and service-pipes, and also instal fittings into the majority of the houses, in doing which they had to face competition from the local plumbers. But the advantage of having all the gas-fittings put in by the Company was that in practically all cases provision has been made for a cooker and gas-fire connection. Out of a total of 315 consumers, the Company have done the gas-fitting for 294. They had also fixed free of charge 135 cookers, and a number of other appliances. The principal gasholder is at Cowdenbeath; but ground was acquired at Aberdour, and a gasholder erected there. An interesting part of the scheme is the arrangement whereby the compressor can be stopped at any time for cleaning, repairing, or even to save steam, and still a supply be automatically maintained on the high-pressure main. This is accomplished by fixing a return valve at the holder which is operated by a diaphragm governor connected with the high-pressure main. If the compressor is stopped, the pressure falls at once; and this releases the return valve.

Boiler Attendants' Wages at Granton.—The case of the boiler attendants at the works of the Edinburgh and Leith Corporations' Gas Commissioners [see "JOURNAL" for March 7, pp. 519, 545], who desired a rise of wages, and who, until wiser counsels prevailed, threatened to strike if they did not get it, came before Sheriff-Substitute Louttit Laing, as Arbitrator, towards the end of March. In his award, recently submitted to the Commissioners, he states that, after carefully considering the evidence, he can see no good reason for disturbing the rate of wages, which should remain as at present.

Edinburgh Gas Matters.—The quantity of gas sold by the Edinburgh and Leith Gas Commissioners during the winter quarter showed a decrease of 11,315,800 cubic feet, or 1·63 per cent. This is more than accounted for by a further large reduction in the consumption by the street-lamps, which for the three months amounted to only 414,700 cubic feet. The value of the gas sold is up by £20,713, for which the increase in the price is responsible.

Female Labour at Dunfermline.—Scarcity of male labour has resulted in the employment by the Dunfermline Corporation of about twenty women, to undertake certain forms of light labour at the gas-works. It is understood that the women are performing their duties in an admirable manner, and that a considerable falling off in the output of gas has thus been prevented.

The Directors of the South African Lighting Association, Limited, have resolved to pay a final dividend of 5 per cent. for the half year ended Dec. 31 (less income-tax at 2s. 10d. in the pound), making, with the interim dividend already paid, 8 per cent. for the year 1915, subject to income-tax at 2s. 8d. in the pound. The dividend is payable on May 31, and is subject to audit.

CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

LONDON, *May* 1.

The London tar products market remains featureless. Pitch is being used regularly for carbonizing purposes; while for export, makers still quote 19s. to 19s. 6d. net per ton *ex* works. Creosote is firm at 4d. to 4¼d. net in bulk at works. Solvent naphtha, 90-160, is in good demand at about 2s. 2d. net per gallon in bulk.

The sulphate of ammonia position is not exactly vigorous, though prices remain unchanged nominally; but it is understood that the only lots now being sold are to relieve stocks at figures below the nominal values.

Tar Products in the Provinces.

May 1.

There is no alteration to record in the markets for tar products. The prices for pitch remain the same. Creosote is still quiet and difficult to sell. Solvent naphtha is steady. Heavy naphtha is in fair demand.

The average values of gas-works products during the past week were: Gas-works coal tar, 15s. 6d. to 19s. 6d. Pitch, East Coast, 15s. to 15s. 6d. per ton; West Coast, 14s. to 14s. 6d. Manchester; 15s. to 15s. 6d. Liverpool; 17s. to 17s. 6d. Clyde. Benzol, 90 per cent., North, 10½d. to 11½d.; 50-90 per cent., naked, North, 1s. 3d. to 1s. 4d. Toluol, naked, North, 2s. 3d. Coal tar crude naphtha, in bulk, North, 6¾d. to 7¼d. Solvent naphtha, naked, North, 2s. Heavy naphtha, naked, North, 1s. 2d. to 1s. 3d. Creosote, in bulk, North, 2¼d. to 2½d. Heavy oils, in bulk, 3¾d. to 4d. Carbolic acid, 60 per cent., East and West Coasts, 3s. 4d. naked. Naphthalene, salts, 80s., bags included. Anthracene, "A" quality, 2d. to 2½d. per unit; "B" quality, nominally ¾d.

Sulphate of Ammonia in the Provinces.

LIVERPOOL, *April* 29.

During the past week there has been even less business passing in this article than is usual at Easter, and, in the absence of support, the market has given way to a small extent. Some of the neutral countries are ready buyers, but it is difficult to obtain the necessary freight room. The nearest values for prompt delivery are now £16 15s. per ton f.o.b. Hull, £16 17s. 6d. f.o b. Liverpool, and £17 f.o.b. Leith. For delivery during the second half of the year, makers require a premium of 7s. 6d. to 12s. 6d. per ton, but no transactions have been reported.

Nitrate of Soda.

There is no change in either the tone of the market or in the price of

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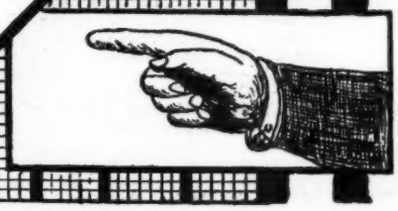

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OLD BROAD ST., E.C.

this material, and quotations are repeated at 18s. 3d. per cwt. for ordinary quality, and at 19s. 3d. for refined, on spot.

Sulphate of Ammonia.

From another source it is reported that the prices of this article are as follows: Outside London makes, £15 17s. 6d.; Hull, £16 12s. 6d.; Liverpool, £16 15s.; Leith, £16 17s. 6d.; Middlesbrough, £16 15s.

COAL TRADE REPORT.

Northern Coal Trade.

The coal trade continues active; but there is little fuel free for sale for the next fortnight. Steamers are in rather better supply, so that the shipments are good in the circumstances. In the steam coal trade, the demand is full; and for delivery in the first half of May, from 45s. to 47s. per ton f.o.b. is asked. Second-class steams are from 35s. to 38s. per ton. For steam smalls, the quotation is from 25s. to 27s. per ton f.o.b. The range of prices is therefore about a record one, even when it is remembered that the usual opening time of the shipping season is at hand, for it will have less influence this year than hitherto. In the gas coal trade, the demand is good for this season, and the output is readily taken up; while the strong request for Durham coals generally stiffens the price of gas qualities. Best Durham gas coal is about 35s. per ton; and second-class are from 27s. 6d. to 30s. "Wear Specials" are very firm, with rather higher nominal quotations. The long contracts for gas coals take up much of the production, so that the prices named apply to relatively limited qualities; but for such for export, high values are obtainable. The freights are still rather quiet; but the payment of sums such as 97s. to Genoa, and 40s. to Rouen, from the Tyne, makes gas coal very high in cost at the foreign centres named, as well as at home ports. Coke is in steady export at 43s. for metallurgical kinds. Gas coke is steady at about 26s. to 28s. 6d. per ton f.o.b. in the Tyne, according to quality.

High-Pressure Lighting at Halifax.—At the instance of the Halifax Gas Committee, a meeting of high-pressure gas consumers was recently held at the Town Hall. The undertaking has a total of 150 of these consumers, of whom about 40 were present. On the recommendation of the Gas Committee, it was agreed that, in view of the lighting restrictions, high-pressure lighting should be suspended until Sept. 30; the change taking effect at once. It was further decided that consumers should pay a small charge in connection with the cost of installation; the sums being 4s. 4½d. per quarter for each 500-candle power lamp, and 5s. 5d. for 1000-candle lamps. A further meeting will be held in the autumn to consider arrangements for the winter.

Water Supply of Rosario.—The report of the Consolidated Water-Works Company of Rosario, Limited, for the year ended Dec. 31, states that, after making provision for the various charges shown in the net revenue account, and also the interim dividends of 3 per cent. on the preference and ordinary shares, there remains a balance of £34,178, including £13,728 brought forward from the previous year. Out of this balance, the Directors propose to pay a further dividend of 3 per cent. on the preference shares, and a further dividend of 5 per cent. on the fully-paid ordinary shares (making 8 per cent. for the year, less income-tax); to place £2000 to the credit of the staff provident fund; and to carry forward £12,978. The number of services increased during the year; but as rents fell, the gross revenue shows a decrease. The commercial crisis in Rosario, though less acute than in the previous year, is still severe; and some time must yet elapse before a return to normal conditions can be expected.

Price of Gas at Southend.—By fourteen votes to three, a resolution has been adopted by the Southend Town Council: "That a Committee of five members be appointed to inquire into the recent increase in the price of gas by the Southend Gas Company, and generally into the working of the gas monopoly, with the view of effecting a reduction in the cost to the consumers; also to inquire whether this result could be best effected by the purchase of the Gas Company's undertaking or by other means." Mr. Potter said he was surprised at the resolution, for freights alone were costing as much as coal cost a short time ago, and the reason for adding something to the price of gas was apparent everywhere. Mr. Ward, on the other hand, thought there were very few places in England where gas was dearer than in Southend, and it was "disgraceful clapping on this 4d." Mr. Johnson remarked that, seeing the Company were paying a 5 per cent. dividend, it could hardly be said they were extorting money out of the town.

APPLICATIONS FOR PATENTS.

[Extracted from the "Official Journal" for April 27.]

Nos. 5580—5870.

CAMPBELL, G.—"Diffusion of heat or reduction of temperature in heating or illuminating devices." No. 5688.
CHAMPENEY, C. C.—"Valves for gas-tanks." No. 5644.
DAVIS, H. N.—"Gas-fires." No. 5625.
GRAESSER, N. H.—"Process for sulphonation of benzol, toluol, &c." No. 5757.
GRIGSBY, B. J.—See Campbell. No. 5688.
HALKETT, R.—"Gas-fired crucible furnaces." No. 5781.
IVES, R. A.—See Campbell. No. 5688.
MARILLIER, F. W.—See Champeney. No. 5644.
MEADOWS, J. M.—"Gas alarm and telegraph." No. 5773.
SMITHEY, M.—"Meters." No. 5848.
SOUTHEY, A. W.—"Production of gaseous fuel." No. 5668.
SUTTON, C. J.—"Manufacture of mantles." No. 5767.
SVENSKA AKTIEBOLAGET GASACCUMULATOR.—"Lighting or heating apparatus for gas mixtures." No. 5754.
TITHERLEY, A. W.—See Graesser. No. 5757.
TWIGG, W. R.—See Davis. No. 5625.

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¶ *Richmond's new "Economic" Cooker; particulars of remarkable results achieved by our Research Department, will be published shortly.*

Leigh-on-Sea Gas-Works.—It was reported at the last monthly meeting of the Southend Town Council that the output for their Leigh Gas-Works during the year ended March 31 was 51,795,900 cubic feet, a decrease of 6,411,300 compared with the previous year. The amount was, however, an increase of 1,015,500 cubic feet on the output of the year 1914, and of 8,981,200 cubic feet on that of 1913.

Manchester Munition Workers Summoned.—At the Manchester Munitions Court, on Saturday, before Mr. A. J. Ashton, K.C., the Recorder, thirty apprentices employed by Messrs. R. & J. Dempster were summoned for stopping work on April 17. Mr. J. Fitzgerald, who represented the firm, stated that the lads had interviewed the officials of the works in regard to an advance of wages, and subsequently struck work for the rest of the afternoon, to hold a meeting. They returned to work the following morning. In reply to questions, the spokesman of the boys stated that they received a war bonus of 20 per cent.; but other lads who were not indentured were getting considerably more money. Mr. Fitzgerald said the apprentices were good boys; and this was the first time they had given any trouble. In imposing a fine of 1s. on three of the boys who had lost an hour, and 2s. 6d. on the remainder, the Chairman told them that if they felt they had any serious grievance as to wages they could get it arbitrated on by the Board of Trade. But they must not stop work.

Gas-Meter Testing.—During the past quarter, 17,696 meters were tested at the gas-meter testing-station of the Middlesex County Council, in respect of which the fees payable amounted to £577. The County Council adopted the Sales of Gas Acts sixteen years ago; and since then 1,259,002 meters have been tested, and fees amounting to £38,468 received. During the past year 64,304 meters were tested; the fees for this number totalling £2079. In the twelve months, the expenditure in connection with the testing-station amounted to £1645. The County Council are thus left with a balance in their favour of £434.

Charge to Power Users at Retford.—When a recommendation of the Gas Committee to place consumers of gas for power on the same terms so far as discount is concerned as ordinary consumers, came before the Retford Town Council, Mr. Haigh, on behalf of the Committee, explained that when it was decided to give 25 per cent. discount to consumers for power it was done to increase the consumption in day time, and so keep the gas-works staff fully employed. Now it was not a question of keeping the staff at the works employed, but of how to get people to do the work. They would, however, have to place the consumers for power on the same level as others, or increase the price of gas to the general public. Alderman Holmes pointed out that the price to consumers for power, with the discount, was only 1s. 9d. per 1000 cubic feet. The resolution was carried.

STOCK MARKET REPORT.

THE Stock Exchange has had a quiet week of business. Re-opening on Tuesday, after the Easter interval, it was thus shorn of a day. Besides this, it had before it the prospect of another holiday on Monday—the 1st of May being a fixed annual closure. However, business was not quite at a standstill; and, what is more, markets for the most part kept their ends pretty well up in spite of some factors of a decidedly depressing character. Prime among these were the collapse of the Government in their futile attempt to procrastinate still further in dealing with the compulsory service question, and the dramatic outbreak of armed rebellion in Ireland. The third crushing blow sustained by them in a single short week—the fall of Kut—was only known after the close of business hours on Saturday. In the gilt-edged market, the War Loan was dull at times, but was regaining strength at the close. Home Rails were quiet almost to stagnation point. They did not, however, show much resultant weakness; and it was said that a shortage of stock had something to do with the torpor. In the Foreign Market, the French Loan was for the most part quite firm, but towards the close seemed to hang-fire a little. Japanese promised better. Americans, and their associated Canadians, had a much better week than of late—taking their tone from the pipings of Wall Street. Argentines have not quite settled down; but they are better than they were. In the Miscellaneous Market, the public favourites had rather a more chequered time. Business in the Gas Market was on a moderate scale, and prices in general were very firmly maintained. Beyond this gratifying feature, there was no particular incident or characteristic.

Bargains done for cash during the week were as follows: On Tuesday, Continental Union 3⅜, Gas Light ordinary 76¼, ditto maximum 60¼, 60⅜, ditto debenture 59⅜, Imperial Continental 59½, Primitiva 1 15/16, ditto preference 3 3/32, 3 9/16, 3⅜, South Metropolitan 76, South Suburban 81⅜. On Wednesday, Bombay 5, Gas Light ordinary 75¼, 75½, 75⅜, 76¼, Imperial Continental 59, 60, Primitiva 1 13/16, South Metropolitan 77. On Thursday, Ascot 8 1/16, Gas Light ordinary 75⅜, 76, ditto preference 74½, Imperial Continental 59¼, 60, Primitiva 1 15/16, 1⅞, ditto preference 3½, South Metropolitan debenture 59¾, 60¼, South Suburban 80½, ditto debenture 89. On Friday, Gas Light ordinary 75¼, 75⅜, 76, ditto debenture 59⅜, 59⅝, Imperial Continental 60, 60¼, Primitiva preference 3⅛, 3 17/32, 3 9/16, 3 19/32. On Saturday, Gas Light debenture 59⅝, Primitiva preference 3⅛, South Metropolitan debenture 60, 60¼.

The Bank rate is 5 per cent.—as fixed on Aug. 8, 1914.

The Wombwell Gas Committee have recommended an increase of wages of 2s. per week to the slot-meter collectors. An application from gas-works employees for an advance has been adjourned.

The Morecambe Corporation have decided to advance the price of coke to 9d. per cwt., which, it was stated at the Council meeting, was 25 per cent. lower than in most towns. The Gas Committee have not raised the price of gas. It was mentioned that the price of coke at the moment in Morecambe was only 13s. 4d. per ton; while the Bradford Corporation were getting 20s per ton.

ANTE-WAR PRICES AND DIVIDENDS, LATEST DIVIDENDS, AND LAST WEEK'S BARGAINS.

Issue.	Share.	When Dividend.	Previous Div or Dividend & Bonus.	Last Dividend.	NAME.	Closing Prices. July 30, 1914.	Yield on Highest Closing Price.	Lowest and Highest Prices of Bargains.
£			p.c.				£ s. d.	
1,551,868	Stk.	April 8	2½	5⅛	Alliance & Dublin Ord.	59—64	8 16 2	..
274,000	,,	July 10	4	4	Do. 4 p.c. Deb.	76—79	5 1 3	..
980,000	5	April 29	7½	3/-	Bombay, Ltd. . . .	5¼—6¼	5 17 8	5
50,000	10	Feb. 26	16	15/-	10 p.c. . .	39—30	5 6 8	..
388,110	10	,,	7	7/-	Bourne- { B ¶ p.c.	15—15½	4 10 4	..
115,000	10	,,	6	6/-	mouth Gas { Pref. 6 p.c.	13½—14	4 5 9	..
159,740	—	—	—	—	and Water { 4 p.c. Deb.	..	—	..
992,045	Stk.	Feb. 26	†14	56/-	Brentford A Consold. .	261—266	5 5 3	..
734,920	,,	,,	†11	55/-	Do. B New . .	204—209	5 5 3	..
55,000	,,	,,	5	5	Do. 5 p.c. Pref. .	109—111	4 10 1	..
221,400	,,	June 11	4	4	Do. 4 p.c. Deb. .	91—98	4 6 0	..
917,880	Stk.	Feb. 26	11	10½	Brighton & Hove Orig.	208—218	5 8 4	..
244,200	,,	,,	8	7½	Do. A Ord. Stk. .	154—159	5 0 8	..
630,000	20	Mar. 26	12½	22/6	British	44—45	5 11 1	..
120,000	Stk.	June 26	4	4	Do. 4 p.c. Deb. Stk.	88—90	4 8 11	..
245,771	Stk.	June 26	4	4	Buenos Ayres 4 p.c. Deb.	85—87	4 12 0	..
100,000	10	—	—	—	Cape Town & Dis., Ltd.	1¼—2¼	—	..
100,000	10	—	—	4/6	Do. 4½ p.c. Pref. .	4—6	—	..
100,000	Stk.	June 26	4½	4½	Do. 4½ p.c. Deb. Stk.	70—75	6 0 0	..
157,150	Stk.	Feb. 26	5	5	Chester 5 p.c. Ord. . .	108—110	4 10 11	..
1,513,280	Stk.	Feb. 12	5/9/4	49/4	Commercial 4 p.c. Stk.	106—108	5 1 2	..
560,000	,,	,,	5½	46/8	Do. 3½ p.c. do. .	103—105	5 1 6	..
475,000	,,	June 11	3	3	Do. 3 p.c. Deb. Stk.	69½—71½	4 8 11	..
800 000	Stk.	,,	4	4	Continental Union, Ltd.	76—79	5 1 3	3⅜
200 000	,,	,,	7	7	Do. 7 p.c. Pref.	115—118	5 18 8	..
278,400	—	—	—	11½	Croydon B and C 7 p.c.	..	—	..
492,270	Stk.	—	6	5½	Derby Con. Stk. . . .	123—125	4 16 0	..
55,000	,,	—	4	4	Do. Deb. Stk. .	102—104	3 16 11	..
1,002,180	10	July 29	10	10/-	European, Ltd. . . .	17½—18	5 11 1	..
16,827,185	Stk.	Feb. 10	4/17/4	42/-	Gas { 4 p.c. Ord. . .	98—102	4 15 6	75½—76½
2,600,000	,,	,,	3½	3½	Light { 3½ p.c. max. .	76—79	4 8 7	60½—60⅝
4,062,235	,,	,,	4	4	and { 4 p.c. Con. Pref.	96—99	4 0 10	74½
4,674,850	,,	June 11	3	3	Coke { 3 p.c. Con. Deb.	72½—74½	4 0 6	59⅞—59¾
130,000	,,	,,	10	10	10 p.c. Bonds .	..	—	..
258,740	Stk.	Mar. 12	5	4½	Hastings & St. L. 3½ p.c.	87—89	5 12 4	..
70,000	10	April 29	11	6	Hongkong & China, Ltd.	16½—16¾	6 11 4	..
86,600	—	—	—	9½	Hornsey 7 p.c. . . .	..	—	..
131,000	Stk.	Mar. 12	7½	7½	Ilford A and C . . .	151—154	5 2 4	..
65,780	,,	,,	6⅝	5⅞	Do. B	115—118	5 8 0	..
65,500	,,	June 26	4	4	Do. 4 p.c. Deb. . .	92—94	4 5 1	..
4,940,000	Stk.	May 14	9	4½	Imperial Continental .	150—160	5 12 6	59—60⅜
1,235,000	Stk.	Feb. 12	3½	3½	Do. 3½ p.c. Deb. Red.	84—86	4 1 5	..
235,242	Stk.	Mar. 12	6½	6½	Lea Bridge Ord. 5 p.c. .	119—121	5 7 5	..
2,498,905	Stk.	Feb. 26	10	5	Liverpool 5 p.c. Ord. { A	211—213	4 13 11	..
					{ B	146—148	4 14 7	..
306,083	,,	June 26	4	4	Do. 4 p.c. Pr. Deb. Stk.	..	—	..
75,000	5	June 11	6	2/-	Malta & Mediterranean	4¼—4⅝	6 9 9	..
250,000	100	April 1	4½	4½	Met. of Melbourne { 4½ p.c. Deb.	99—101	4 9 1	..
541,920	20	May 28	4	6/-	Monte Video, Ltd. . .	11½—12	6 13 4	..
1,575,892	Stk.	July 29	4½	4½	Newc'tle&G'tesh'd Con.	98½—99½	4 10 6	..
529,705	Stk.	June 26	3½	3½	Do. 3½ p.c. Deb.	82—83	4 4 10	..
55,940	10	Feb. 26	7/14/0	7/8/8	North Middlesex 7 p.c.	14—15	5 2 8	..
300,000	Stk.	May 14	8	8	Oriental, Ltd. . . .	117—122	6 11 2	..
60,000	5	Mar. 26	10	1/-	Ottoman, Ltd. . . .	7½—7¾	6 9 0	..
60,000	50	Feb. 26	12	65/-	Porisea, Island B . .	128—131	4 19 3	..
100,000	50	,,	12	60/-	Do. C . .	118—121	4 19 3	..
52,000	50	,,	10	—	Do. D . .	..	—	..
249,980	5	April 29	8	—	Primitiva Ord. . . .	5½—6	6 18 4	1 13/16—1 15/16
499,960	5	June 26	5	2/6	,, 5 p.c. Pref. .	4½—5	5 0 0	3½—3⅝
521,600	100	June 2	4	4	,, 4 p.c. Deb. .	91—93	4 6 0	..
—	—	—	—	4	,, ,, ,, 1911	..	—	..
846,198	Stk.	June 26	4	4	River Plate 4 p.c. Deb.	85—87	4 12 0	..
150,000	10	May 14	6	6/-	San Paulo { 6 p.c. Pref.	10½—11	5 9 1	..
125,000	50	July 1	5	5	{ 5 p.c. Deb.	47—49	5 2 0	..
135,000	Stk.	Mar. 12	10	10	Sheffield A	228—234	4 9 8	..
209,984	,,	,,	10	10	Do. B	222—224	4 9 8	..
623,500	,,	,,	10	10	Do. C	220—222	4 10 1	..
90,000	10	May 28	9	6/-	South African . . .	10½—11½	7 16 6	..
5,609,895	Stk.	Feb. 10	5/4/0	44/-	South Met., 4 p.c. Ord.	111—113	4 16 8	76—77
1,895,445	,,	July 10	3	3	Do. 3 p.c. Deb.	72½—74½	4 0 6	59½—60½
224,820	Stk.	Feb. 26	8½	8	South Shields Con. Stk.	157—159	5 6 11	..
952,795	Stk.	Feb. 26	6	48/4	S'th Suburb'n Ord. 5 p.c.	114—116	5 8 5	80½—81½
60,000	,,	,,	5	5	Do. 5 p.c. Pref. .	110—112	4 9 8	..
135,000	—	—	—	48/4	Do. West Kent. .	..	—	..
187,558	,,	June 26	5	5	Do. 5 p.c. Deb. Stk.	116—118	4 4 9	89
647,740	Stk.	May 14	5	5	Southampton Ord. . .	99—102	4 18 0	..
120,000	Stk.	Feb. 12	7½	7½	Tottenham { A 5 p.c. .	135—138	5 8 8	..
782,275	,,	,,	6	6	District { B 3½ p.c. .	115—117	5 2 7	..
181,265	,,	June 26	4	4	{ 4 p.c. Deb.	87—89	4 9 11	..
182,380	10	Dec. 30	5	—	Tuscan, Ltd.	5—6	8 6 8	..
149,900	10	July 1	5	5	Do. 5 p.c. Deb. Red.	93—95	5 5 8	..
236,476	Stk.	Mar. 12	5	5	Tynemouth, 5 p.c. max.	103½—109½	4 11 4	..
					Wandsworth, Wimbledon, and Epsom—			
80,000	Stk.	Feb. 26	8⅛	78/9	Wandsworth A 5 p.c.	151—156	5 7 4	..
265,636	,,	,,	6¼	63/9	,, B 3½ p.c.	129—134	5 2 7	..
108,075	,,	,,	5/17/8	55/1½	,, C 3½ p.c.	110—115	5 2 0	..
359,000	,,	,,	6¼	57/6	Wimbledon 5 p.c. .	117—122	5 0 5	..
98,000	,,	,,	6⅜	63/9	Epsom 5 p.c. . . .	121—126	5 5 2	..
88,416	,,	June 26	3	3	3 p.c. Deb. Stk. . .	66—69	4 6 11	..

† Paid on Old 10 .c. and 7 p.c. Standard Stocks.

WANTED, FOR SALE, CONTRACTS, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Appointments, &c., Vacant.

GAS MANAGER. Maryport Urban District Council. Applications by May 10.
CLERK. Chichester Gas Company.
ERECTOR AND REPAIRER, &c. Desborough Gas-Works.
GAS FITTERS. No. 6175.
LEADING STOKER. Seaford Gas Company.
GAS STOKER. No. 6177.

Appointment Wanted.

GAS ENGINEER. No. 6176.

Plant, &c. (Second Hand), for Sale.

GAS EXHAUSTERS. Nechells Gas-Works, Birmingham.

TENDERS FOR Coal.

ASHFORD GAS DEPARTMENT. Tenders by May 11.
DEWSBURY GAS DEPARTMENT. Tenders by May 13.
DONCASTER GAS DEPARTMENT. Tenders by May 12.
HORNCASTLE GAS DEPARTMENT. Tenders by May 13.
PORTRUSH GAS COMPANY. Tenders by May 10.
SHEFFIELD GAS COMPANY. Tenders by May 4.
SHREWSBURY GASLIGHT COMPANY. Tenders by May 26.

NOTICES TO CORRESPONDENTS, ADVERTISERS, AND SUBSCRIBERS.

No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer—not necessarily for publication, but as a proof of good faith.

COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office NOT LATER than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders to Alter or stop PERMANENT ADVERTISEMENTS should be received by the FIRST POST on Saturday.

Wanted, For Sale, and Tender Advertisements, Six Lines and under 3s.; each additional Line, 6d.

TERMS OF SUBSCRIPTION to the "JOURNAL."
United Kingdom: One Year, 23s. 6d.; Half Year, 12s.; Quarter, 6s. 6d.
Payable in advance. If credit is taken, an extra charge of 4s. a year is made.
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All Communications, Remittances, &c., to be addressed to WALTER KING, 11, BOLT COURT, FLEET STREET, LONDON, E.C.

Telegrams: "GASKING, FLEET LONDON." Telephone: Holborn 6857.

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O'NEILL'S OXIDE
For GAS PURIFICATION.
LARGEST SALE OF ANY OXIDE.

SPENT OXIDE PURCHASED IN ANY DISTRICT.

GAS PURIFICATION & CHEMICAL CO., LD.,
PALMERSTON HOUSE,
OLD BROAD STREET, LONDON, E.C.

"VOLCANIC" FIRE CEMENT.
Resists 4500° Fahr. Best for GAS-WORKS.
ANDREW STEPHENSON, 171, Palmerston House, Old Broad Street, London, E.C. "Volcanism, London."

SPENCER'S PATENT HURDLE GRIDS.

THE very best Patent Grids for Holding Oxide Lightly.
See Illustrated Advertisement, Feb. 22, p. 440.

MEWBURN, ELLIS, AND PRYOR.
CHARTERED PATENT AGENTS AND TRADE MARK AGENTS,
70, Chancery Lane, London.
Telegrams: "Patent London." 'Phone: 243 Holborn.
And 3, St. Nicholas Buildings, Newcastle-on-Tyne.

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SPECIALLY prepared for the manufacture of SULPHATE OF AMMONIA.
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HUTCHINSON BROTHERS, Ltd.,
FALCON WORKS, BARNSLEY.

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GAS METERS (Ordinary and Prepayment),
"FALCON" INVERTED LAMPS and SQUARE LANTERNS for Street Lighting,
INVERTED BURNERS and CONVERSION SETS for Street Lamps.

ENQUIRIES SOLICITED.

FOR Gas-Works Plant of Every Description; also SULPHATE OF AMMONIA and SULPHUR RECOVERY PLANTS.
C. & W. WALKER, LIMITED,
DONNINGTON, NEWPORT, SALOP.

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SATURATORS and all LEAD and TIMBER WORK in connection with Sulphate Plants.
We Guarantee promptness with efficiency for Repairs.
JOSEPH TAYLOR AND CO., CENTRAL PLUMBING WORKS, BOLTON.
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REPAIRS RECEIVE PROMPT ATTENTION.
Telephones: 815 Oldham, and 2412 Hop, London.
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SEND your inquiries for Carburetted HYDROGEN AND BLUE WATER-GAS PLANT, also TAR DEHYDRATING PLANT and other GAS-WORKS APPARATUS to—
BALE AND HARDY,
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(ESTABLISHED 1850),
WET AND DRY METERS.
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STREET LAMPS AND AUTOMATIC CONTROLLERS.
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JOHN RILEY & SONS, Limited, Chemical Manufacturers, Hapton, near Accrington, are MAKERS of Special SULPHURIC ACID, for Sulphate of Ammonia Making. Highest percentage of Sulphate of Ammonia obtained from the use of this Vitriol, which has now been used for upwards of 50 years. References given to Gas Companies.

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GAS LIGHTING ENGINEERS AND CONTRACTORS.
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Telegrams: "DACOLIGHT LONDON." Telephone: 2336 HOLBORN.

"GAZINE" (Registered in England and Abroad). A radical Solvent and Preventative of Naphthalene Deposits, and for the Automatic Cleaning of Mains and Services.
It is also used for the Enrichment of Gas.
Manufactured and Supplied by C. BOURNE, West Moor Chemical Works, KILLINGWORTH, or through his Agents, F. J. NICOL & CO., Pilgrim House, NEWCASTLE-ON-TYNE.
Telegrams: "DORIC," Newcastle-on-Tyne. National Telephone No. 2497.

GAS-WORKS requiring Extensions should Communicate with FIRTH BLAKELEY, SONS, AND CO., LIMITED, Dewsbury, who make a Speciality of Catering for the Smaller Gas Concerns. Prices Reasonable; quality and results, the best. Satisfaction Guaranteed.

IMPORTANT to Incandescent Mantle MANUFACTURERS.—Expert advice given on the Manufacturing of Incandescent Mantles, Thorium, Collodium, and all Chemicals in connection with it; also on the Best Plant and Machinery for Knitting, Washing, Burning, &c.
Apply "D. W. 8802," RICARDO'S Adv. Bur., AMSTERDAM, Holland.

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We are in a position to Supply Oxide of Iron promptly, and invite Enquiries.
SPENT OXIDE WANTED.
BALE & CHURCH, LTD.
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Tins for sale to Consumers.
In Bulk for Works Use.
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MARYPORT URBAN DISTRICT COUNCIL.

GAS MANAGER.

SHORT NOTICE.

THE Council invite Applications for the Appointment as MANAGER. Make, under normal Lighting Conditions, 53 Millions.
Applicants to state Salary required. The Salary now paid is £150, with Free House, Light, and Firing.
Applications, stating Age, and giving full Information as to Experience and present Position, with *copies* of recent Testimonials, to be delivered to the undersigned not later than Wednesday, May 10, inst.
Canvassing Disqualifies.
Town Hall, Maryport. F. KELLY, Clerk to the Council.

WORKS CHEMIST.—No. 6165.

THE Position of Works Chemist advertised in the "JOURNAL" under No. 6165 HAS NOW BEEN FILLED, and Candidates are THANKED for their Applications.

GAS Engineer, over Twenty Years' Experience, Coal, Gas, and Residuals, wishes EMPLOYMENT. Good References. Over Military age.
Address, No. 6176, care of Mr. KING, 11, Bolt Court, FLEET STREET, E.C.

EXPERIENCED Clerk required for Fitting Department, Ineligible for Military Service.
Apply, stating Age, Qualifications, and Salary required, to the SECRETARY, Chichester Gas Company, Gas-Works, CHICHESTER.

LEADING Stoker Wanted. Must be used to Engine and Boiler. Scoop Charging. Wages, 37s. 6d. per week exclusive War Bonus. Reasonable Holidays.
Apply to the MANAGER, Gas Company, SEAFORD, Sussex.

GAS Stoker for Night Duty required for a Six Million Works. Used to Shovel Charging, Boiler, Engine, and Exhauster. Wages, 31s. 6d. per Week.
Apply, by letter, to No. 6177, care of Mr. KING, 11, Bolt Court, FLEET STREET, E.C.

WANTED, for the Duration of the War, a MAN, Ineligible for Service, with a thorough knowledge of Gas Manufacture, able to Erect and carry out Repairs to Plant, undertake Internal Fitting, Repairs to Mains, and Service Laying. Should necessity arise, to do occasional Stoking.
Apply, by letter, stating Age, Experience, and Wage required, to the MANAGER, Gas-Works, DESBOROUGH.